

SmartCella/SmartCella 3PH

Electronic controllers for cold rooms

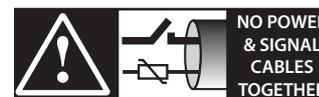
CAREL



(ENG) User manual

**LEGGI E CONSERVA
QUESTE ISTRUZIONI**

**READ AND SAVE
THESE INSTRUCTIONS**



READ CAREFULLY IN THE TEXT!

High Efficiency Solutions

WARNING



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.

The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, available on the website www.CAREL.com and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subsidiaries be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or impossibility to use the product, even if CAREL or its subsidiaries are warned of the possibility of such damage.

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.

**NO POWER
& SIGNAL
CABLES
TOGETHER**

READ CAREFULLY IN THE TEXT!

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.

Content

1. INTRODUCTION	7	9. TECHNICAL SPECIFICATIONS	42
1.1 Main features	7	9.1 Technical specifications.....	42
1.2 Accessories.....	8	9.2 SmartCella 3PH wiring diagrams.....	44
2. INSTALLATION	9	9.3 Connections for pump down operation managed by Smartcella.....	48
2.1 Dimensions (mm).....	9	10. APPENDIX 1: VPM (VISUAL PARAMETER MANAGER)	50
2.2 Wall mounting.....	9	10.1 Installation	50
2.3 Wiring diagram.....	10	10.2 Opening the program.....	50
2.4 Installation.....	13	10.3 Computer - key connection.....	50
2.5 Programming key IROPZKEY00/A0.....	13	10.4 Programming.....	50
2.6 Remote display connection.....	14	10.5 Modify a parameter	51
2.7 Network connection.....	14	10.6 Add a set of parameters.....	51
3. USER INTERFACE	15	10.7 Write parameters.....	51
3.1 Display.....	15	11. APPENDIX 2: ADVANCED FUNCTIONS	52
3.2 Keypad.....	15	11.8 Variation of the defrost interval.....	52
3.3 Signal LEDs.....	16	11.9 Defrost with 2 evaporators.....	53
3.4 Programming.....	16	11.10 Second compressor with rotation.....	53
4. COMMISSIONING	19		
4.1 Configuration.....	19		
4.2 Loading the sets of parameters.....	20		
4.3 Preparing for operation.....	20		
5. FUNCTIONS	21		
5.1 Probes (analogue inputs).....	21		
5.2 Digital inputs.....	21		
5.3 Digital outputs.....	25		
6. CONTROL	26		
6.1 Switching the controller On/Off	26		
6.2 Virtual probe.....	26		
6.3 Set point.....	26		
6.4 Pump down.....	27		
6.5 Autostart in pump down	27		
6.6 Continuous cycle.....	28		
6.7 Anti-sweat heater.....	28		
6.8 Light and Aux outputs.....	28		
6.9 Defrost.....	29		
6.10 Evaporator fans.....	31		
6.11 Condenser fans.....	32		
6.12 Duty setting (par. c4).....	32		
6.13 Running time defrost (par. d10, d11).....	32		
7. PARAMETER TABLE	33		
7.14 Variables only accessible via serial connection.....	36		
8. SIGNALS AND ALARMS	37		
8.1 Signals.....	37		
8.2 Alarms.....	37		
8.3 Reset alarms.....	37		
8.4 HACCP alarms and display	37		
8.5 Alarm parameters	40		
8.6 HACCP alarm parameters and monitoring.....	40		
8.7 High condenser temperature alarm	41		
8.8 Frost protection alarm.....	41		
8.9 Defrost ended by timeout alarm.....	41		

1. INTRODUCTION

SmartCella comprises a series of microprocessor-based parametric electronic controllers, with LED display, designed to control single-phase cold rooms with single-phase or three-phase loads.

This controller is 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.

SmartCella 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 or contactor (three-phase);
- vertical or horizontal wall mounting, depending on the model;
- 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;
- cold room light management;
- 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:

- management of single-phase and/or three-phase loads
- the type of power supply: transformer 230V~, switching 115/230 V~;
- the number of relay outputs;
- vertical or horizontal installation.

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

SmartCella is designed to offer maximum installation flexibility. In addition to the control probe, further four 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 of a cold room

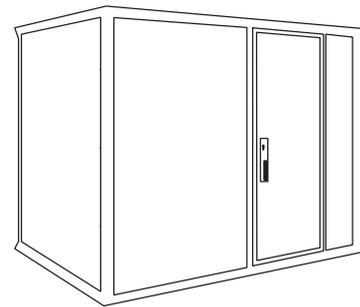


Fig. 1.a

Single-phase version part numbers

P/N	Description
WE00S1EN00	1 relay: compressor (16 A), 230 Vac, 180° screw terminals
WE00C2HN00	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals
WE00C2HM00	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals + IROPZSER30 serial card
WE00C2HC00	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals + RTC
WE00C3HN00	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals + 3 HP relay
WE00C2HN0H	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals, horizontal installation
WE00S1ET00	1 relay: compressor (16 A), 230 Vac, 180° screw terminals + I/O switch and wiring
WE00C2HT00	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals + I/O switch and wiring
WE00S1EN0A	1 relay: compressor (16 A), 230 Vac, 180° screw terminals, assembled with Ultra Power module
WE00C2HN0A	4 relays: compressor (2 HP) , defrost (16 A), evaporator fans (8 A), AUX (8 A), 115/230 Vac, 180° screw terminals, assembled with Ultra Power module

Tab. 1.a

Three-phase version part numbers

P/N	Description
WP00B14A10	SmartCella 3PH 5.5HP 1.6-2.5A motor protector 3PH 6kW defrost 1PH 500W evaporator fans 1PH 800W condenser fans 1PH 800W light
WP00B24A10	Smartcella 3PH 5.5HP 2.5-4A motor protector 3PH 6kW defrost 1PH 500W evaporator fans 1PH 800W condenser fans 1PH 800W light
WP00B34A10	Smartcella 3PH 5.5HP 4-6.3A motor protector 3PH 6kW defrost 1PH 500W evaporator fans 1PH 800W condenser fans 1PH 800W light
WP00B44A10	Smartcella 3PH 5.5HP 6.3-10A motor protector 3PH 6kW defrost 1PH 500W evaporator fans 1PH 800W condenser fans 1PH 800W light

P/N	Description
WP00B47B20	Smartcella 3PH 7.5HP 6.3-10A motor protector 3PH 9kW defrost 3PH 2kW evaporator fans 1PH 800W condenser fans 1PH 800W light
WP00B57B20	Smartcella 3PH 7.5HP 10-16A motor protector 3PH 9kW defrost 3PH 2kW evaporator fans 1PH 800W condenser fans 1PH 800W light

Tab. 1.b



Fig. 1.f

1.2 Accessories

IROPZKEY00/A0 programming key

The IROPZKEY00 and IROPZKEY00A0 (powered) programming keys can be used with SmartCella. 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 customizable parameters). The read/write operations are carried out with the controller off.

IROPZKEY00



Fig. 1.b

IROPZKEYA0



Fig. 1.c

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.d

Remote display (P/N IREXGD000)

The remote display (for model with switching power supply) can be used to display one of the system variables.



Fig. 1.e

RS485 serial interface (P/N IROPZ48500 and IROPZ48550)

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 IROPZ48550 features a microprocessor and can automatically recognize the TxRx+ and TxRx signals (reverse connection).

RS485 serial board (P/N IROPZSER30)

The IROPZSER30 board is used to connect SmartCella via the RS485 network serial to supervisory system (using the removable terminal supplied), as well as direct connection of the instrument to the repeater display using a PSTCON**B00 cable.

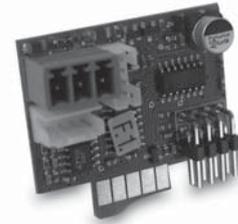


Fig. 1.g

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.h

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.i

2. INSTALLATION

2.1 Dimensions (mm)

Single-phase version

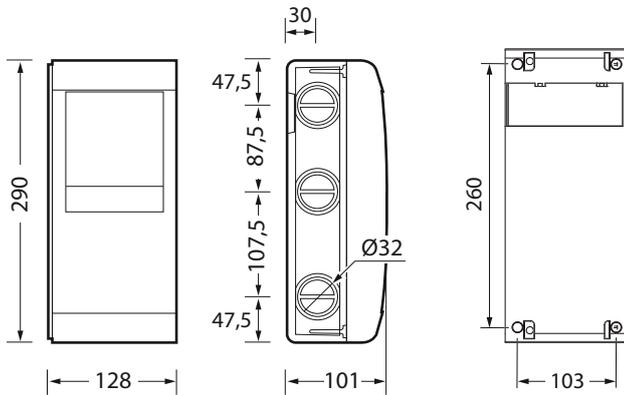


Fig. 2.a

Three-phase version

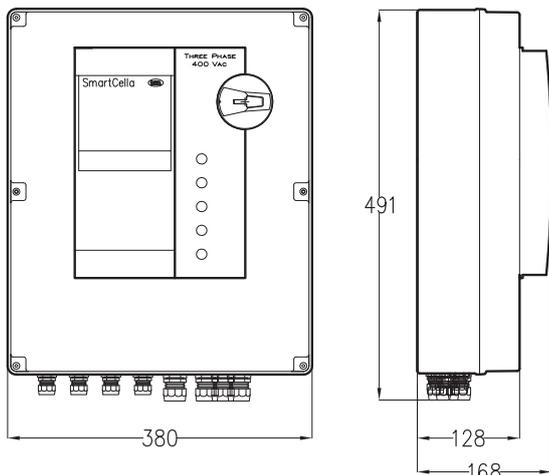


Fig. 2.b

Drilling template

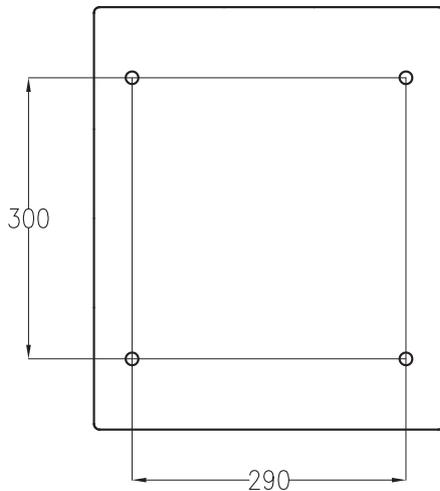
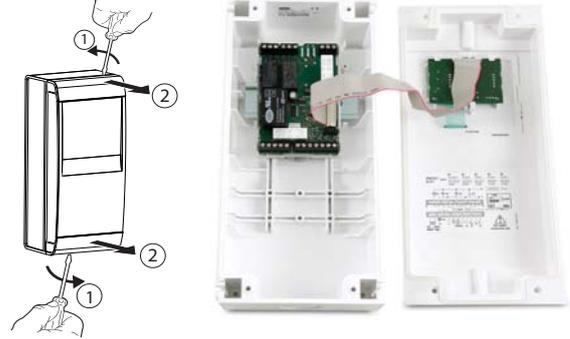


Fig. 2.c

2.2 Wall mounting

Single-phase version



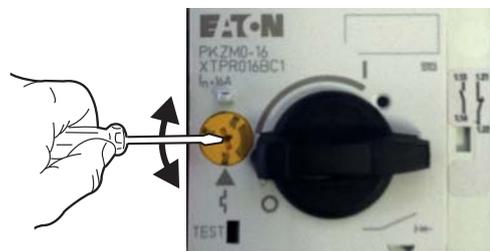
1. Remove the faceplates (1 and 2) and unscrew the screws to open the control



2. Release flat connector to remove frontal panel
3. a. Mounting with DIN rail: Fix the DIN rail on the wall and insert the controller. Mark the positions of the 2 bottom holes corresponding to drilling template and extract the control. Drill the 2 holes (\varnothing 4,5 mm), insert again the control and fix the 2 bottom screws
3. b. Mounting without DIN rail: Mark the positions of the 4 holes corresponding to drilling template, drill the holes (\varnothing 4,5 mm) and fix control to wall with 4 screws
4. Complete the wiring of the cables and the necessary components
5. Insert flat connector and frontal panel box to electronic board. Close the front panel fixing the 4 supplied screws corresponding to the holes

Three-phase version

1. With reference to the drilling template, drill the four fastening holes in the wall:
 - Unscrew the six fastening screws on the front panel
 - Remove the front panel
 - Fix the panel to the wall using screws of suitable length, based on the thickness of the wall
2. Connect the power cables, the load power cables, the probes and the remaining inputs/outputs to the terminal block on the panel, as shown in the wiring diagram (see page 10/11)
3. Before starting installation, the motor protector should be calibrated based on effective compressor power consumption, with reference to the compressor's rated data



4. Arm the circuit breakers and the motor protector
5. Close the front panel using the six screws
6. Power the panel on
7. Arm the main switch (yellow/red)

Warning

- separate the power cables (power supply, loads) from the signal cables (probes, digital inputs) and the serial cable
- use cables that are suitably sized for the current they carry
- connect the terminal marked PE to the mains power supply earth
- after having powered the three-phase expansion, check correct current draw of the various loads

2.3 Wiring diagram

Single-phase version

WE00SxExxx

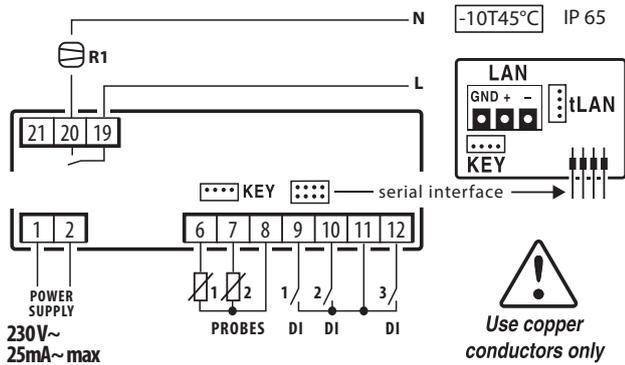


Fig. 2.d

WE00CxHxxx

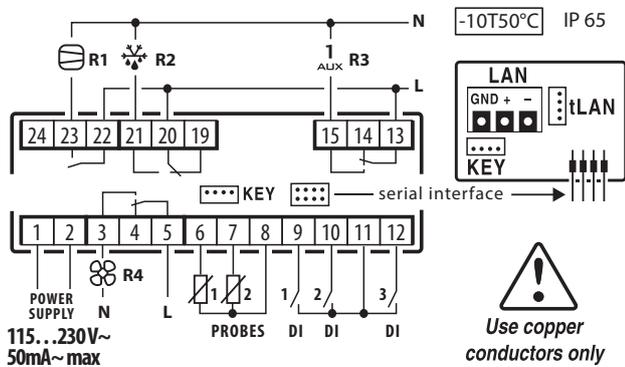


Fig. 2.e

Three-phase version

Layouts and components

(WP00B34A10, WP00B24A10, WP00B14A10)

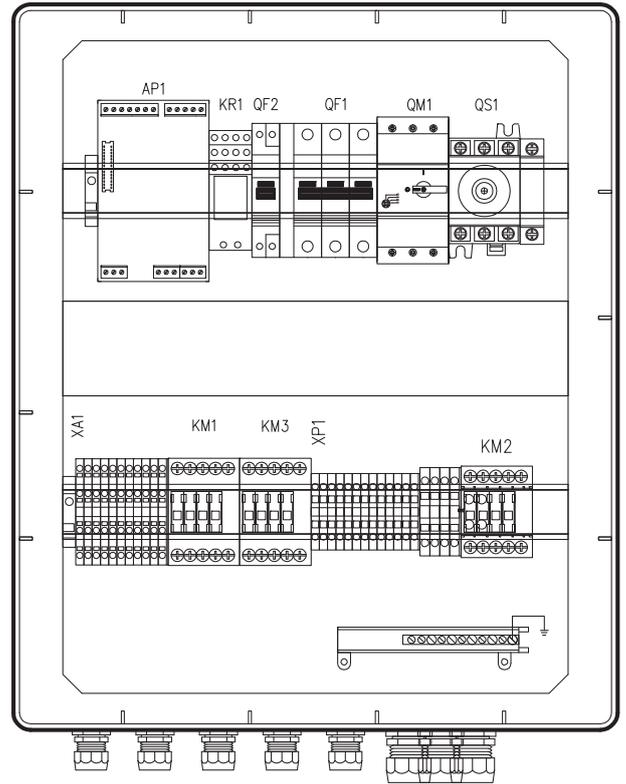


Fig. 2.f

WP00B57B20, WP00B47B20, WP00B44A10

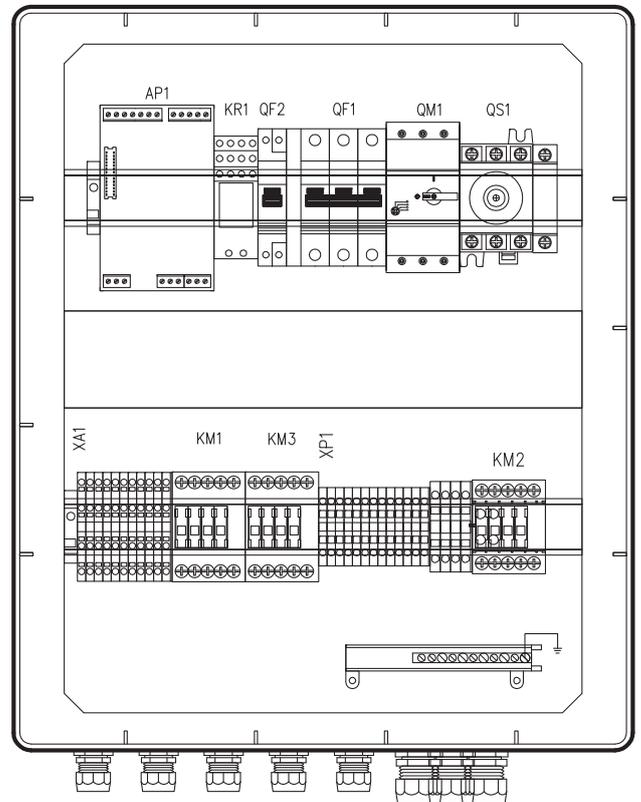


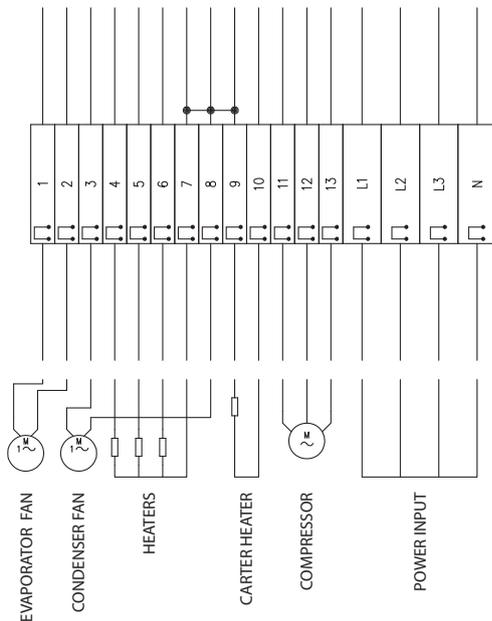
Fig. 2.g

Code	Description
AP1	Smartcella
HL1	Power light
HL2	Evaporator light
HL3	Compressor light
HL4	Alarm light
HL5	Defrost light
KM1	Evaporator fan contactor
KM2	Compressor contactor
KM3	Defrost heater contactor
KR1	Alarm relay
QF1	Evaporator/condenser fan/defrost heater circuit breaker
QF2	Auxiliary circuit breaker
QM1	Compressor motor protector
QS1	Main disconnect switch
XA1	Auxiliary terminal block
XP1	Power terminal block

Terminal block

WP00B44A10, WP00B34A10, WP00B24A10, WP00B14A10

Terminal block XP1



Terminal block XA1

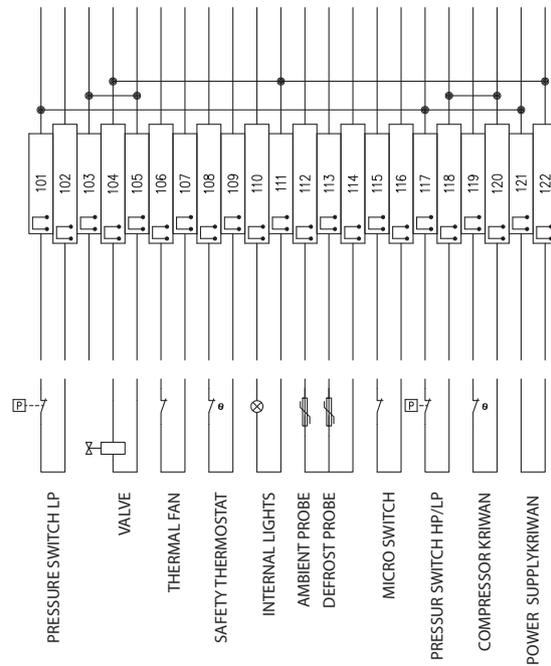


Fig. 2.h

Terminal block	Number	Description	Type
XP1	1	Evaporator fan	Output
	2		
	3	Condenser fan	Output
	4		
	5	Defrost heaters	Output
	6		
	7	Crankcase heater	Output
	8		
	9	Compressor	Output
	10		
	11	Compressor	Output
	12		
	13	Power supply input	Input
	L1		
L2			
L3			
N			

Tab. 2.c

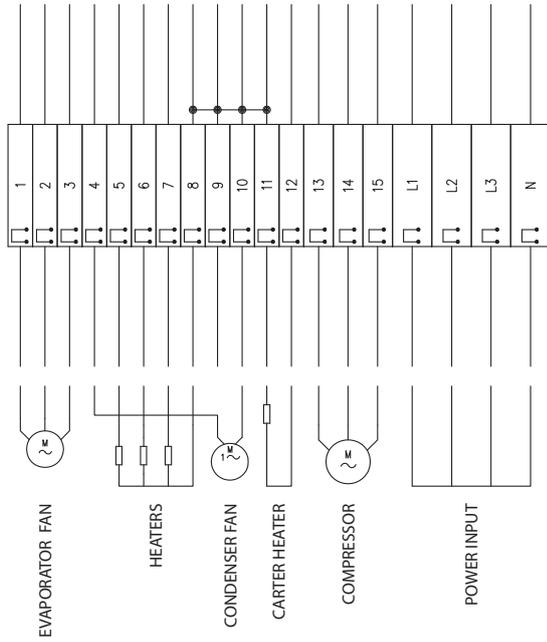
Terminal block	Number	Description	Type
XA1	101	LP pressure switch	Input
	102		
	104	Solenoid valve	Output
	105		
	106	Fan thermal protector	Input
	107		
	108	Safety thermostat	Input
	109		
	110	Inside lights	Output
	111		
	112	Room probe	Input
	113		
	114	Defrost probe	Input
	115		
	116	Door microswitch	Input
	117		
	118	HP/LP pressure switch (*)	Input
	119		
120	Compressor Kriwan (*)	Input	
121			
122	Kriwan power supply	Output	

Tab. 2.d

(*) **Warning:** if input 117-118 and/or 119-120 are not connected, the control will show an "IA" alarm.

Code WP00B57B20, WP00B47B20

Terminal block XP1



Terminal block XA1

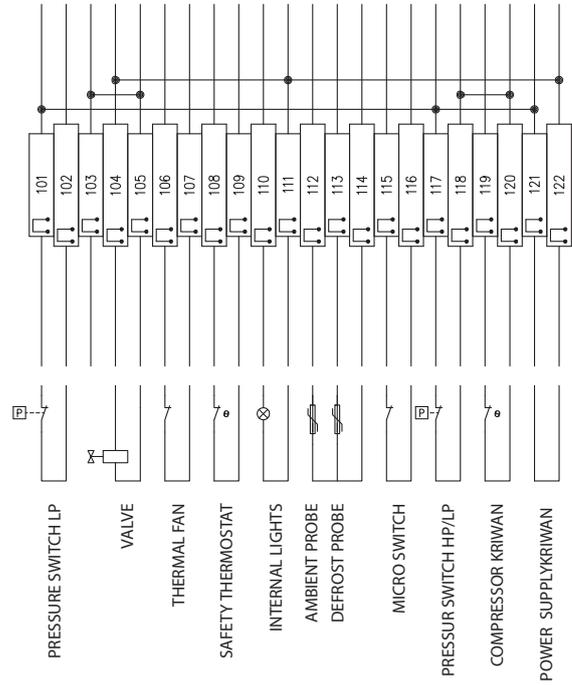


Fig. 2.i

Terminal block	Number	Description	Type
XP1	1		
	2	Evaporator fan	Output
	3		
	4	Condenser fan	Output
	5		
	6	Defrost heaters	Output
	7		
	8		
	11	Crankcase heater	Output
	12		
	13	Compressor	Output
	14		
	15		
	L1	Power supply input	Input
L2			
L3			
N			

Tab. 2.e

Terminal block	Number	Description	Type
XA1	101		
	102	LP pressure switch	Input
	103		
	104	Valve	Output
	105		
	106	Fan thermal protector	Input
	107		
	108	Safety thermostat	Input
	109		
	110	Inside lights	Output
	111		
	112	Room probe	Input
	114	Defrost probe	Input
	113		
	114		
	115	Door microswitch	Input
	116		
	117	HP/LP pressure switch (*)	Input
118			
119	Compressor Kriwan (*)	Input	
120			
121	Kriwan power supply	Output	
122			

Tab. 2.f

(*) **Warning:** if input 117-118 and/or 119-120 are not connected, the control will show an "IA" alarm.

2.4 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 mm². 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 capacities of the relays or three-phase contactors, 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 or serial board IROPZSER30). 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.

Cleaning the controller

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

2.5 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.

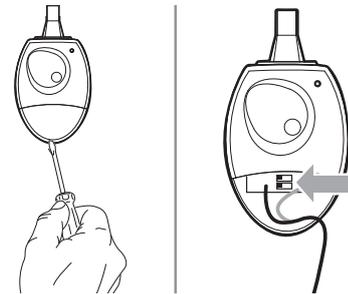


Fig. 2.j

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. <u>Replace the batteries.</u>
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.g

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.

2.6 Remote display connection

To connect the remote display, use the dedicated cable (P/N PSTCON0*B0) and serial card (P/N IROPZSER30). 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	Not fitted	4	Probe 3		
1	Virtual probe	5	Probe 4		
2	Probe 1	6	Reserved		
3	Probe 2				

Tab. 2.a

2.7 Network connection

Warnings:

- As serial converter, both IROPZSER30 and IROPZ485x0 can be used;
- the RS485 converter is sensitive to electrostatic discharges and therefore must be handled with extreme care;
- check the documents on the serial 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 serial interface cables separate from the power cables (relay outputs and power supply).

The RS485 converter is used to connect SmartCella 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 CVSTDUMORO) 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.

Note: SmartCella can communicate with both Carel and Modbus protocols with auto-recognition

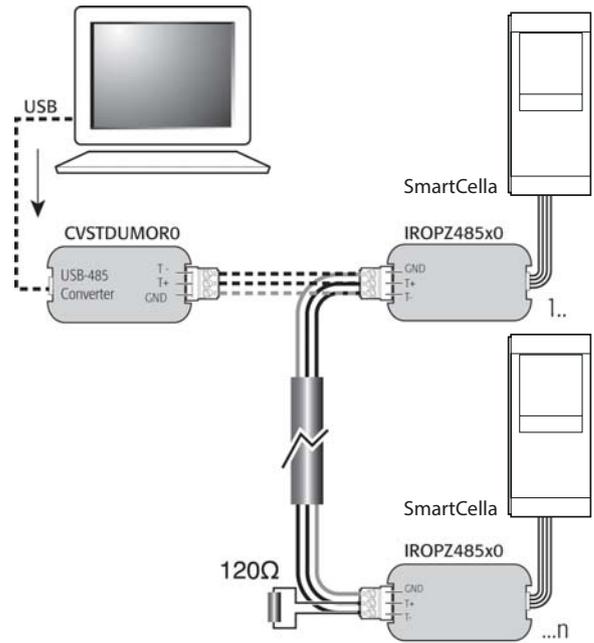


Fig. 2.k

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.

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 and 19.9°C.

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 output	AUX output 1 or 2 active	-	Anti-sweat heater function active	
	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)	
	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	
	Continuous cycle	Continuous cycle function active	-	Function called	Flashes when activation is delayed or inhibited by protection times
	HACCP	function enabled (HA and/or HF)	function enabled (HA and/or HF)	function not enabled, HACCP alarm saved	
	CLOCK	function activated	function not activated	function request	ON if RTC featured

Tab. 3.a

3.2 Keypad

Button	Normal function		Start-up
	Pressing the button alone	Pressing together with other buttons	
	if pressed for more than 3 s accesses the menu for setting the password to access the type "F" (frequent) parameters or "C" (Configuration) in the event of alarm: silences the audible alarm (buzzer) and disables the alarm relay	PRG+ON-OFF/UP: if pressed together for more than 3 s reset any alarm with manual reset	if pressed for more than 5 s at start-up, starts the default parameter setting
	if pressed for more than 3 s disables the regulation / if pressed for more than 1 s, enables the regulation during the parameters modification increase the value displayed move towards the next parameter	ON-OFF/UP+AUX/DOWN: if pressed together for more than 3 s enable/disable the continuous cycle operation ON- OFF/UP+ SET/DEF: if pressed together for more than 3 s display the temperature read by the defrost probe no 1 ON-OFF/UP+ PRG/MUTE: if pressed together for more than 3 s reset any alarm with manual reset	
	if pressed for more than 1 s, enables/disables the auxiliary output during the parameters modification decrease the value displayed or move towards the previous parameter	AUX/DOWN + ON-OFF/UP: if pressed together for more than 3 s enable/disable the continuous cycle operation AUX/DOWN + SET/DEF: if pressed together for more than 1 second, displays a submenu used to access the parameters relating to HACCP alarms (HA, HAn, HF, HF _n , if available)	
	if pressed for more than 1 s, enables/displays and/or set the set point if pressed for more than 5 s, enables a manual defrost	SET/DEF+ ON-OFF/UP: if pressed together for more than 3 s display the temperature read by the defrost probe no 1 SET/DEF+ ON-OFF/UP: if pressed together for more than 3 seconds, displays the temperature read by defrost probe 1	

Tab. 3.b

3.3 Signal LEDs

Icon	Colour	Function	Status		Notes
			ON	OFF	
	Green	POWER	Auxiliary circuit powered	Auxiliary circuit not powered	LED on depending on the status (ON) of circuit breaker QF2 and disconnect switch QS1
	Yellow	COMPRESSOR	Power available at compressor power terminals	No power at compressor power terminals	LED on depending on the status (ON) of motor protector QM1 and whether power is available
	Yellow	EVAPORATOR FAN	Power available at evaporator fan power terminals	No power at evaporator fan power terminals	LED on depending on the status (ON) of circuit breaker QF1 and whether power is available
	Yellow	DEFROST	Power available at defrost power terminals	No power at defrost power terminals	LED on depending on the status (ON) of circuit breaker QF1 and whether power is available
	Red	ALARM	Alarm activated	Normal operation	LED on depending on: activation of circuit breaker QF1 and/or motor protector QM1 and/or alarm input (high pressure switch or compressor Kriwan)

Tab. 3.c



Note: the status of the LED (On/Off) obviously depends on the operating logic of the panel (e.g. if the temperature reaches the set point, the compressor and the corresponding LED will be switched off by the electronic controller, without generating alarms)

3.4 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.

3.4.1 Setting the set point

How to set the set point (desired temperature value)

Step	Action	Effect	Meaning
1	Press for 1 second	After 1 second the display will show the current set point	This the currently active control set point
2	Press or or	The value on the display will increase or decrease	Set the desired value
3	Press	The controller will show the temp.read by the probes again	The set point is modified and saved

Tab. 3.d

Another way of changing the set point is to set parameter "St" (see the tables below)

3.4.2 Setting type "F" and "C" parameters

Step	Action	Effect	Meaning
1	Press for 3 seconds	After 3 seconds the display will show the 1st parameter, "0" (Password)	Access to type "F" parameters is direct without password
2	Press or or	The value on the display will increase or decrease.	Enter the password "22" to access the type "C" parameters or whatever different value for the type "F" parameters.
3	Press	The display will show "St" (Setpoint)	This is the current value of the Setpoint
4	Press or or	If the password set is 22 the display will scroll the list of type "C" parameters (CONFIGURATION) otherwise the list of type "F" parameters (FREQUENT)	Set the desired value
5	Press	The display will show the parameter name	This is the current value of the parameter
6	Press or or	The value on the display will increase or decrease	Set the desired value

Step	Action	Effect	Meaning
7	Press	The display will show the parameter name again	IMPORTANT: parameters not yet saved
8	Repeat steps 2, 3, 4 & 5 for all parameters required		
9	Press for 5 seconds	The controller will display the temperature read by the probes again	IMPORTANT: only now have all the parameters been updated

Tab. 3.e

For both types of access (type "F" and type "C") there is a timeout (no button on the keypad pressed for 1 min), the procedure is ended without saving the parameter.

3.4.3 Parameter categories

- 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.

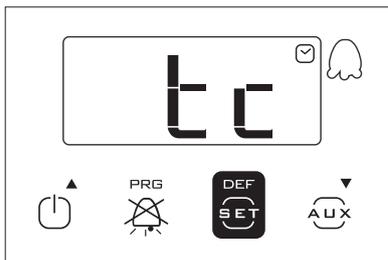
Parameter categories

Category	Text	Icon	Category	Text	Icon
Probes	Pro		Alarms	ALM	
Control	CtL		Fan	FAn	
Compressor	CMP		Configuration	CnF	
Defrost	dEF		HACCP	HcP	
			Clock	rtc	

Tab. 3.f

Example 1: setting the current time/date (for models with RTC)

1. Access the type C parameters as described in the corresponding paragraph;
2. Press UP/DOWN and select the parent parameter tc, or press the PRG button to select the "rtc" parameter category and then parameter tc;
3. Press Set: parameter y is displayed following by two digits that indicate the current year;
4. Press Set and set the value of the current year (e.g.: 17=2017), 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=hours, m=minutes;
7. To return to the list of main parameters press Prg/mute and then set 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.



3.4.4 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" or "Bn0" (on SmartCella 3PH) are 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.

3.4.5 Defrost

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

ACTIVATION: Press SET for 5 seconds:

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 defrost	1	0	2	-
	0 = Temperature alternating with dEF				
	1 = Display disabled				
	2 = dEF				

Tab. 3.g

DEACTIVATION: Press SET for 5 seconds:

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

3.4.6 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.

3.4.7 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 ON/OFF + AUX 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.

DEACTIVATION: Press ON/OFF + AUX for 5 seconds +

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

3.4.8 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.

3.4.9 Auxiliary/light output activation

To activate the auxiliary (H1 = 2) and/or light output (H1 = 3) from the keypad:

- press AUX;
- 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.

3.4.10 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.

3.4.11 HACCP menu

The controller must be fitted with RTC (real time clock).

To enter the HACCP menu:

- press the DEF + buttons together for 1 s;
- press UP/DOWN to display the HACCP parameters;
- press PRG for 5 seconds to return to the standard display.

3.4.12 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 SET/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 AUX 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
/tI	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	1	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

FUNCTION	par. H2						
	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	Button	Function
0	1		Display defrost temp.; enter HACCP; defrost
1	2		Activation of AUX output 1, continuous cycle
2	4		Up, On-Off
3	8		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 SmartCella platform controllers feature a maximum of 5 analogue inputs, which are used for NTC, high temperature NTC (NTC Enhanced Range) or PTC temperature sensors (see the note below). Probes S3, S4 and S5 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, S5 can be selected using parameters /A2, /A3, /A4, /A5. The probes can be calibrated to adjust their readings. In particular, parameters /c1 to /c5 are used to increase or decrease the values read by the probes connected to inputs S1, S2, S3, S4, S5 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 2 = PTC Standard Range -50T150°C	0	0	2	-
/c1	Probe 1 calibration	0	-20	20	°C/°F
/c2	Probe 2 calibration	0	-20	20	°C/°F
/c3	Probe 3 calibration	0	-20	20	°C/°F
/c4	Probe 4 calibration	0	-20	20	°C/°F
/c5	Probe 5 calibration	0.0	-20	20	°C/°F

Tab. 5.a

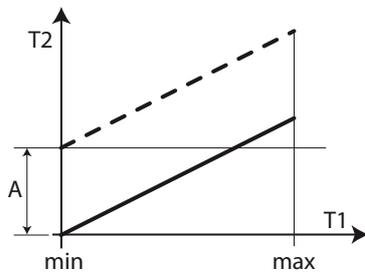


Fig. 5.a

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, S5

The controller, inside the 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, 4 and 5 as digital input 1, 2 and 3 respectively, set parameters /A3 e /A4 and /A5 =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)	2	0	4	-
	0 Absent				
	1 Product (display only)				
	2 Defrost				
	3 Condenser				
	4 Frost				

Par.	Description	Def	Min	Max	UOM
/A3	Probe 3 configuration (S3)	0	0	3	-
	0 Digital input 1 (DI1)				
	1 Product (display only)				
	2 Defrost				
	3 Condenser				
	4 Frost				
/A4	Probe 4 configuration (S4/ DI2)	0	0	4	-
	0 Digital input 2 (DI2)				
	1 Product (display only)				
	2 Defrost				
	3 Condenser				
	4 Frost				
/A5	Probe 5 calibration (S5/ DI3)	0	0	4	-
	0 Digital input 3 (DI3)				
	1 Product (display only)				
	2 Defrost				
	3 Condenser				
	4 Frost				

Tab. 5.b

5.2 Digital inputs

Digital inputs DI1, DI2 and DI3 respectively can be enabled in the place of probes S3, S4 and S5. Digital inputs 1, 2, 3 must first be enabled (par. /A3 and /A4 = 0) and then assigned to a specific function (par. A4, A5 and A9). 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, A5 and A9): 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

Setting	PARAMETERS A4, A5 and A9	
	Setting	Contact
	OPEN	CLOSED
0 = not active	-	-
1 = immediate external alarm	active	not active
2 = delayed external alarm	active	not active
3 = select probe	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	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, A5 and A9.

Par.	Description	Def	Min	Max	UOM
A4	Multifunction digital input 1 configuration (DI1) See the previous table	0	0	14	-
A5	Multifunction digital input 2 configuration (DI2) See the previous table	0	0	14	-
A9	Multifunction digital input 2 configuration (DI3) 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:

- the following actions occur:
 - a signal is shown on the display ('1A');
 - the icon  flashes;
 - the buzzer is activated, if enabled;
 - the alarm relay is activated, if selected;
- 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 = Enable defrost

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

4 = IStart 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.

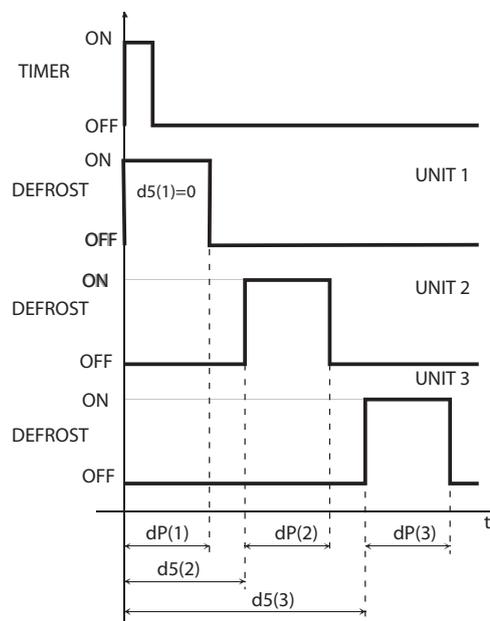


Fig. 5.b

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:

- light off;
- 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 "dl" is updated. If "dl" 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/set point variation

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

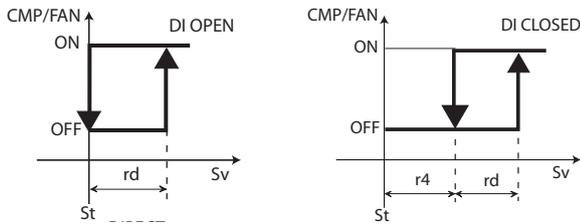


Fig. 5.d

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.

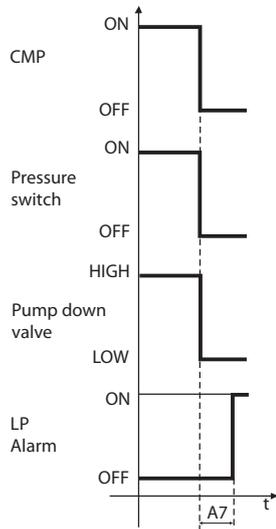
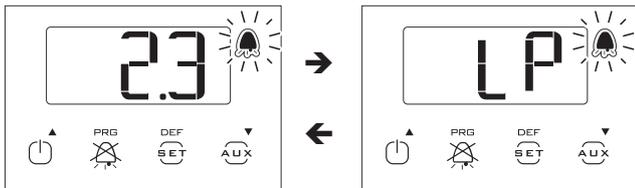


Fig. 5.e

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.

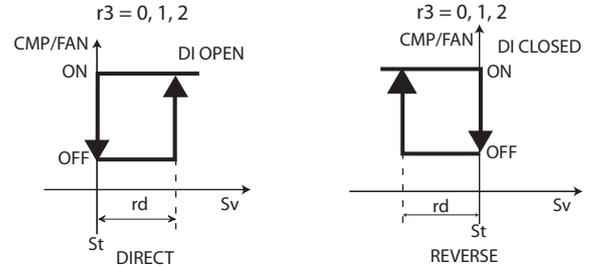


Fig. 5.f

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

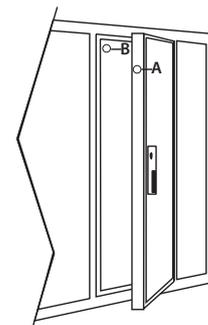


Fig. 5.g

	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 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

CAREL

12 = Auxiliary output

Set H1 and/or H5 = 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, A9 =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	0	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).

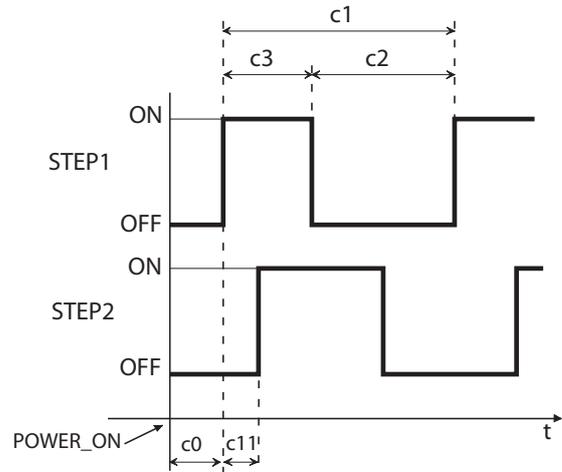


Fig. 5.h

Key

Step1	Compressor step 1
Step2	Compressor step 2
t	time

Function assigned to AUX

Outputs 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	1	0	13	-
	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				

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 show the temperature selected for parameter /tl, 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 and S5 can be assigned functions such as product probe (display only), defrost probe, condenser probe or frost protection probe. In special cases, it is useful to define the virtual probe (Sv) as the control probe, being ideally the average between the outlet probe and the intake probe.

Par.	Description	Def	Min	Max	UOM
St	Set point	0	r1	r2	°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:

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

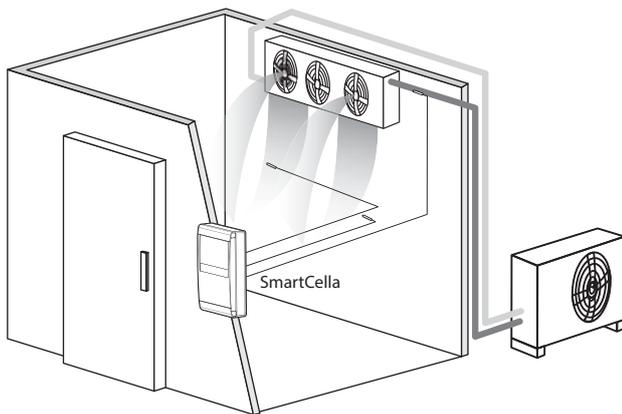


Fig. 6.a

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
St	Set point	0	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

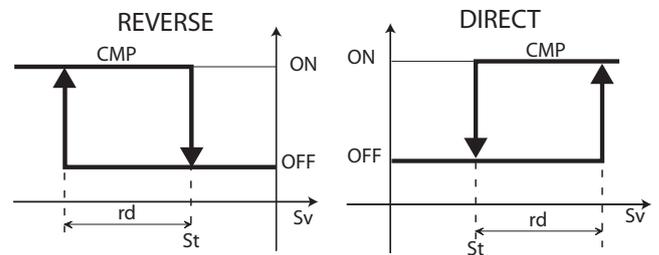


Fig. 6.b

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 $St \pm rd/2$ and the AUX output at $St \pm rd$, as illustrated in the following figure.

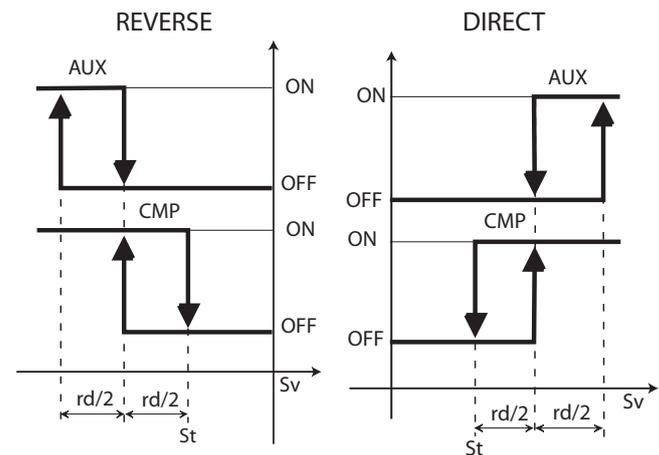


Fig. 6.c

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.

r3=0,1

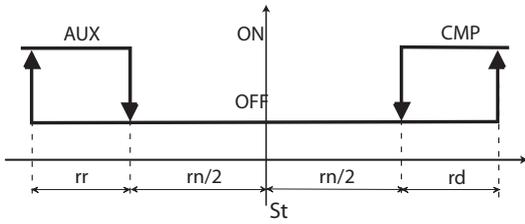


Fig. 6.d

Reverse operation (r3 =2), in the case of 1 compressor output (CMP)

r3=2

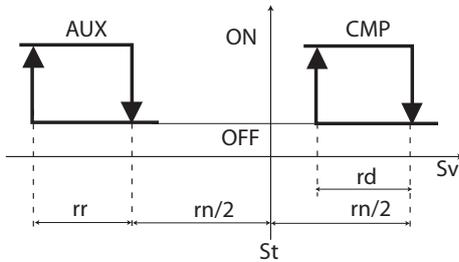


Fig. 6.e

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 = Disabled 1 = Pump down whenever closing pump down valve & following low pressure switch activation with no cooling demand	0	0	1	-
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.

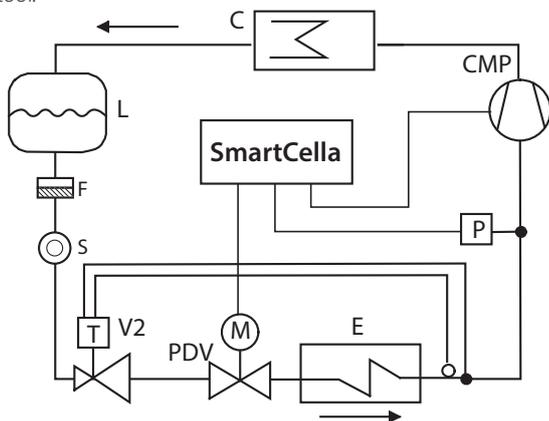


Fig. 6.f

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

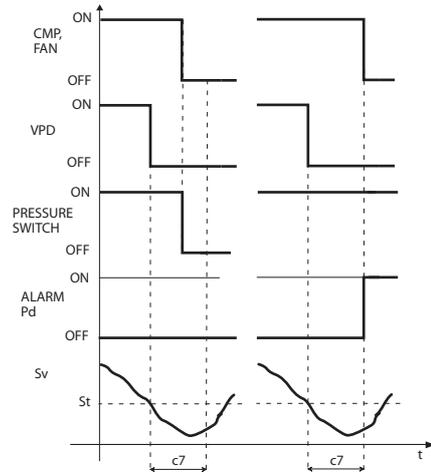


Fig. 6.g

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

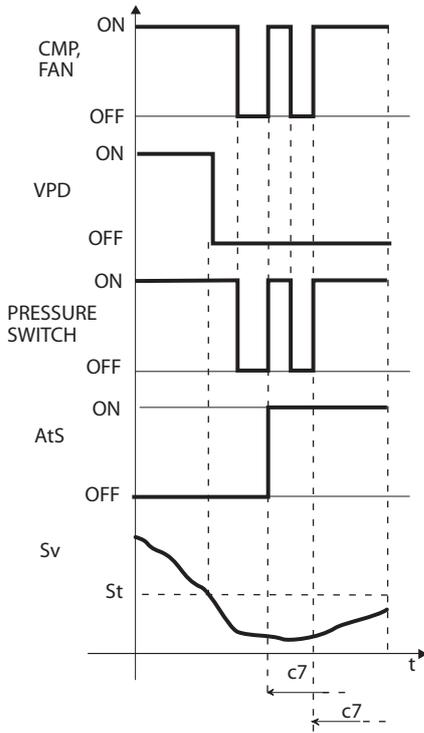


Fig. 6.h

Key

CMP, FAN	Compressor, fan
VPD	Pump down valve
Pressure switch	Pressure switch
Sv	Control probe
St	Set point
c7	Maximum pump down time
t	Time
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 ($H1 = 2$)

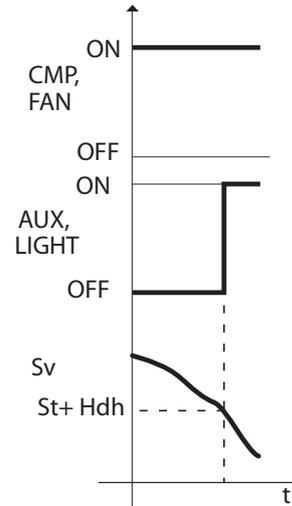


Fig. 6.i

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	0.0	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

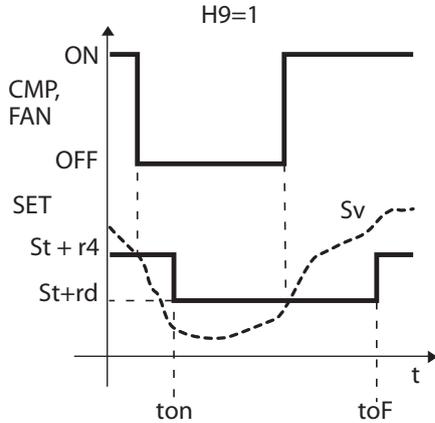


Fig. 6.j

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

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

Smartcella 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
dt3	End defrost temperature probe 4	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.

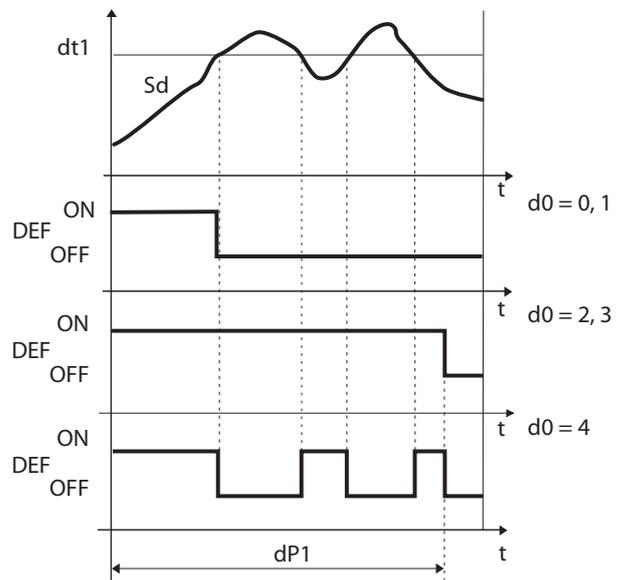


Fig. 6.k

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

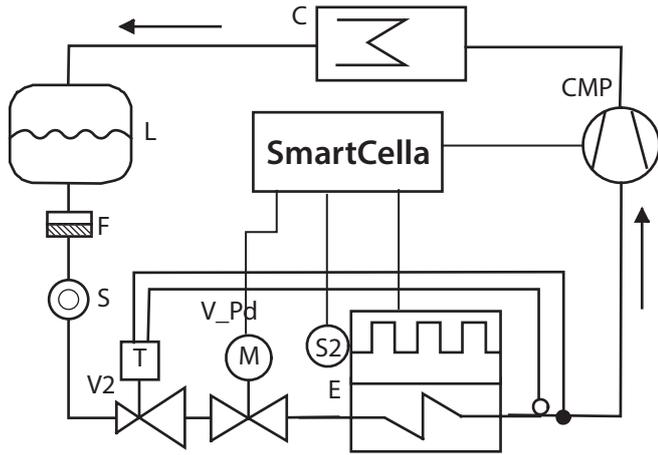


Fig. 6.l

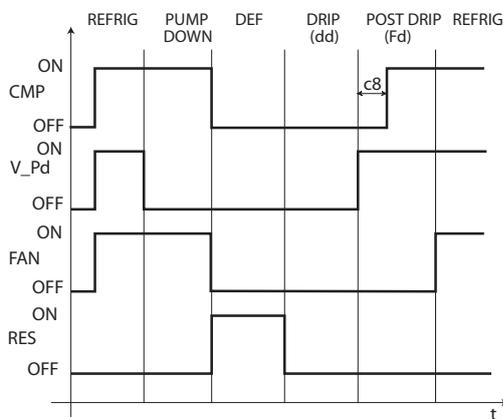


Fig. 6.m

Key		Refrig	Cooling
CMP	Compressor		
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.

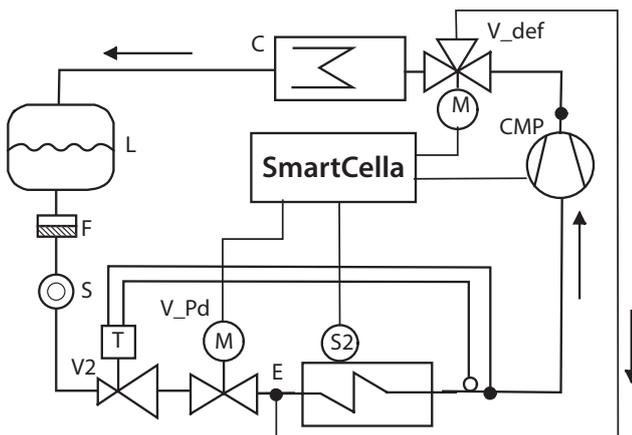


Fig. 6.n

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

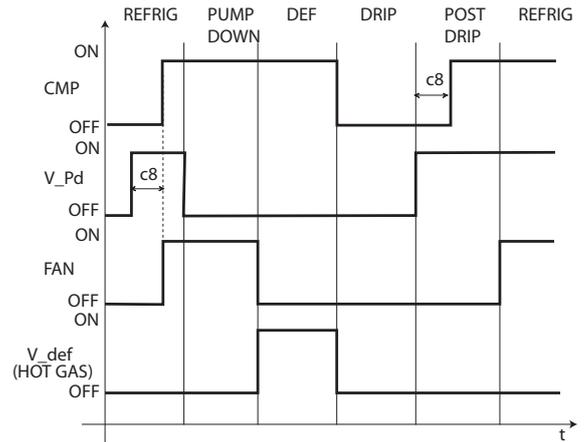


Fig. 6.o

Key		Refrig	Cooling
CMP	Compressor		
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
dl	Maximum time between consecutive defrosts	8	0	250	hr/ min

Tab. 6.k

Parameter dl is a safety parameter used to perform cyclical defrosts every "dl" 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 dl 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 dl a new defrost starts.

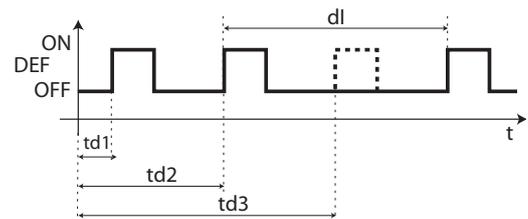


Fig. 6.p

Key	
dl	Maximum time between consecutive defrosts
td1...td3	Programmed defrosts
DEF	Defrost
t	Time

Note:

- if dl 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 "dl"=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 dl	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 = dl in hours, dP1 and dP2 in minutes 1 = dl 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 dl (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.

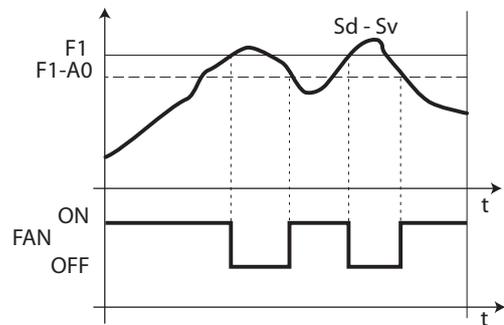
Note: during the dripping time and post-dripping time, if set, the evaporator fans are always off

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

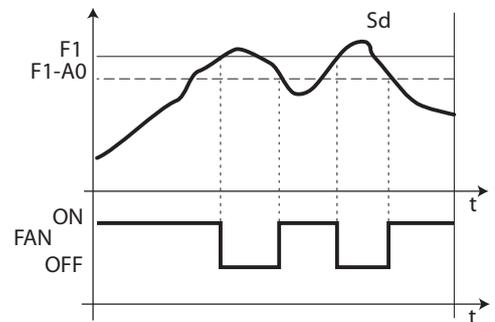


Fig. 6.q

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	1	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

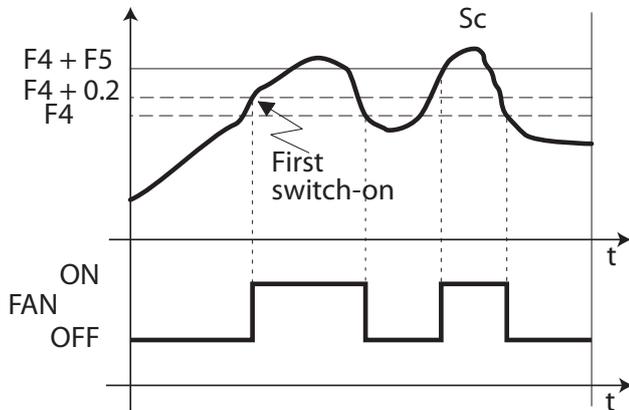


Fig. 6.r

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

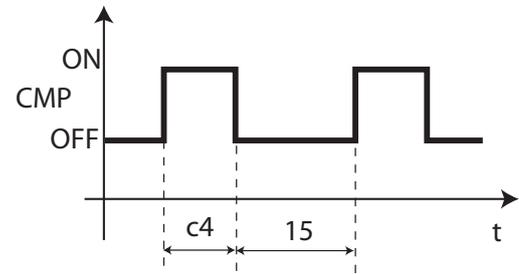


Fig. 6.s

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. 5.a

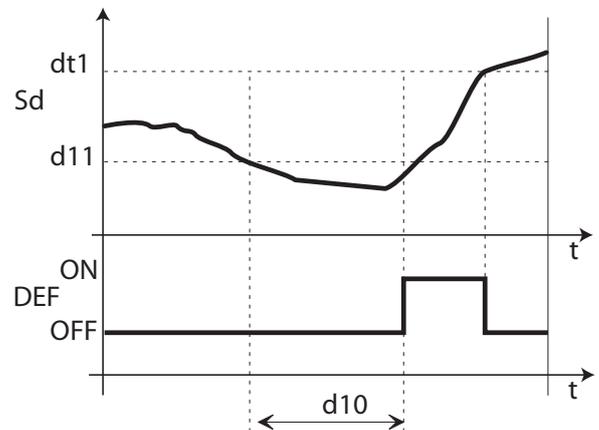


Fig. 6.t

Key			
Sd	Defrost probe	t	time
DEF	Defrost		

7. PARAMETER TABLE

Symbol	Code	Parameter	Models	U-M.	Type	Min.	Max.	Def.
	Pw	Password	WE00S%, WE00C% e WP%	-	C	0	200	22
	/2	Measurement stability	WE00S%, WE00C% e WP%	-	C	1	15	4
	/3	Probe display stability	WE00S%, WE00C% e WP%	-	C	0	15	0
	/4	Virtual probe composition	WE00S%, WE00C% e WP%	-	C	0	100	0
	/5	Temperature unit of measure (0: °C, 1: °F)	WE00S%, WE00C% e WP%	flag	C	0	1	0
	/6	Display decimal point with tenths of a degree without tenths of a degree	WE00S%, WE00C% e WP%	flag	C	0	1	0
	/tl	Display on user terminal 1: virtual probe 2: probe 1 3: probe 2 4: probe 3 5: probe 4 6: reserved 7: set point	WE00S%, WE00C% e WP%	-	C	1	7	1
	/tE	Reading on remote display 0: remote terminal not present 1: virtual probe 2: probe 1 3: probe 2 4: probe 3 5: probe 4 6: reserved	WE00S%, WE00C% e WP%	-	C	0	6	0
	/P	Type of probe 0: NTC standard with range -50T90°C 1: NTC enhanced with range -40T150°C 2: PTC standard with range -50T150°C	WE00S%, WE00C% e WP%	-	C	0	2	0
	/A2	Configuration of probe 2 (S2) 0: absent 1: product (display only) 2: defrost 3: condenser 4: antifreeze	WE00S%	-	C	0	4	0
			WE00C% e WP%	-	C	0	4	2
	/A3	Configuration of probe 3 (S3/DI1) As for /A2	WE00S%, WE00C% e WP%	-	C	0	4	0
	/A4	Configuration of probe 4 (S4/DI2) As for /A2	WE00S%, WE00C% e WP%	-	C	0	4	0
	/A5	Configuration of probe 5 (S5/ID3) As for /A2	WE00S%, WE00C% e WP%	-	C	0	4	0
	/c1	Calibration of probe 1	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	0.0
	/c2	Calibration of probe 2	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	0.0
	/c3	Calibration of probe 3	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	0.0
	/c4	Calibration of probe 4	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	0.0
	/c5	Calibration of probe 5	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	0.0
	St	Set Point	WE00S%, WE00C% e WP%	°C/°F	F	r1	r2	0.0
	rd	Differential	WE00S%, WE00C% e WP%	°C/°F	F	0.1	20	2.0
	rn	Dead band	WE00S%, WE00C% e WP%	°C/°F	C	0.0	60	4.0
	rr	Reverse differential	WE00S%, WE00C% e WP%	°C/°F	C	0.1	20	2.0
	r1	Minimum set point	WE00S%, WE00C% e WP%	°C/°F	C	-50	r2	-50
	r2	Maximum set point	WE00S%, WE00C% e WP%	°C/°F	C	r1	200	60
	r3	Operating mode 0: Direct with defrost control (cooling) 1: Direct (cooling) 2: Reverse-cycle (heating)	WE00S%, WE00C% e WP%	flag	C	0	2	0
	r4	Automatic night-time set point variation	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	3.0
	r5	Enable temperature monitoring 0: disabled, 1: enabled	WE00S%, WE00C% e WP%	flag	C	0	1	0
	rt	Duration of current max and min temperature monitoring session	WE00S%, WE00C% e WP%	ore	F	0	999	-
	rH	Maximum temperature read	WE00S%, WE00C% e WP%	°C/°F	F	-	-	-
rL	Minimum temperature read	WE00S%, WE00C% e WP%	°C/°F	F	-	-	-	
	c0	Compressor, fan and AUX start delay at power on	WE00S%, WE00C% e WP%	min	C	0	15	0
	c1	Minimum time between successive compressor starts	WE00S%, WE00C% e WP%	min	C	0	15	0
	c2	Minimum compressor OFF time	WE00S%, WE00C% e WP%	min	C	0	15	0
	c3	Minimum compressor ON time	WE00S%, WE00C% e WP%	min	C	0	15	0
	c4	Compressor running time with duty setting	WE00S%, WE00C% e WP%	min	C	0	100	0
	cc	Continuous cycle duration	WE00S%, WE00C% e WP%	ore	C	0	15	0
	c6	Low temperature alarm bypass after continuous cycle	WE00S%, WE00C% e WP%	ore	C	0	250	2
	c7	Maximum pump down time (PD) 0: pump down disabled	WE00S%, WE00C% e WP%	s	C	0	900	0
	c9	Enable autostart function in PD 0: disabled 1: pump down whenever closing pump down & following low pressure switch activation with no cooling demand	WE00S%, WE00C% e WP%	flag	C	0	1	0
	c10	Pump down by time or pressure 0: Pump down by pressure 1: Pump down by time	WE00S%, WE00C% e WP%	flag	C	0	1	0
	c11	Second compressor start delay	WE00S%, WE00C% e WP%	s	C	0	250	4

Symbol	Code	Parameter	Models	U-M.	Type	Min.	Max.	Def.
	d0	Typo of defrost 0: Electric heater by temperature 1: Hot gas by temperature 2: Electric heater by time (Ed1, Ed2 not shown) 3: Hot gas by time (Ed1, Ed2 not shown) 4: Electric heater by time with temperature control (Ed1, Ed2 not shown)	WE00S%, WE00C% e WP%	flag	C	0	4	0
	dl	MAximum time between consecutive defrosts 0: defrost not performed	WE00S%, WE00C% e WP%	ore	F	0	250	8
	dt1	End defrost temperature probe 2	WE00S%, WE00C% e WP%	°C/°F	F	-50	200	4.0
	dt2	End defrost temperature probe 3	WE00S%, WE00C% e WP%	°C/°F	F	-50	200	4.0
	dP1	Maximum defrost duration	WE00S%, WE00C% e WP%	min	F	1	250	30
	dP2	Maximum defrost duration, aux evaporator	WE00S%, WE00C% e WP%	min	F	1	250	30
	d3	Defrost activation delay	WE00S%, WE00C% e WP%	min	C	0	250	0
	d4	Defrost at start-up 0: disabled 1: enabled	WE00S%, WE00C% e WP%	flag	C	0	1	0
	d5	Defrost delay on start-up (if d4=1) or from DI	WE00S%, WE00C% e WP%	min	C	0	250	0
	d6	Terminal display during defrost 0: Alternating display of temperature and dEF value 1: display disabled 2: dEF	WE00S%, WE00C% e WP%	-	C	0	2	1
	dd	Dripping time after defrost (fans off)	WE00S%, WE00C% e WP%	min	F	0	15	2
	d8	High temperature alarm bypass time after defrost (and door open)	WE00S%, WE00C% e WP%	ore	F	0	250	1
	d8d	Alarm bypass time after door open	WE00S%, WE00C% e WP%	min	C	0	250	0
	d9	Defrost priority over compressor protectors 0: The protection times c1, c2 and c3 are observed 1: The protection times c1, c2 and c3 are not observed	WE00S%, WE00C% e WP%	flag	C	0	1	0
	d/1	Display of defrost probe 1	WE00S%, WE00C% e WP%	°C/°F	F	-	-	-
	d/2	Display of defrost probe 2	WE00S%, WE00C% e WP%	°C/°F	F	-	-	-
	dC	Time base for defrost 0: dl in hours, dP1 and dP2 in minutes 1: dl in minutes, dP1 and dP2 in seconds	WE00S%, WE00C% e WP%	flag	C	0	1	0
	d10	Defrost time in running time mode 0= function disabled	WE00S%, WE00C% e WP%	ore	C	0	250	0
	d11	Running time defrost temperature threshold	WE00S%, WE00C% e WP%	°C/°F	C	-20	20	1.0
	d12	Advanced defrost	WE00S%, WE00C% e WP%	-	C	0	3	0
	dn	Nominal defrost duration	WE00S%, WE00C% e WP%	-	C	1	100	65
	dH	Proportional factor for variation of dl	WE00S%, WE00C% e WP%	-	C	0	100	50
	A0	Alarm and fan differential	WE00S%, WE00C% e WP%	°C/°F	C	0.1	20	2.0
	A1	Alarm threshold ('AL' and '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	WE00S%, WE00C% e WP%	flag	C	0	1	0
	AL	Low temperature alarm threshold	WE00S%, WE00C% e WP%	°C/°F	F	-50	200	0.0
AH	High temperature alarm threshold	WE00S%, WE00C% e WP%	°C/°F	F	-50	200	0.0	
Ad	Low and high temperature alarm delay	WE00S%, WE00C% e WP%	min	F	0	250	120	
	A4	Digital input 1 configuration (DI1) 0: Input not active 1: Immediate external alarm 2: Delayed external alarm 3: If model M, probe selection 3: Other models enable defrost 4: Start defrost 5: Door switch with compressor and fan stop 6: Remote on/off 7: Curtain switch 8: Low pressure switch 9: Door switch with fan stop 10: Direct/reverse operation 11: Light sensor 12: Activation of AUX output 13: Door switch with compressor and fans off and light not managed 14: Door switch with fans off and light not managed	WE00S% e WE00C% WP%	- -	C C	0 0	14 14	0 5
	A5	Digital input 2 configuration (DI2) / As for A4	WE00S% e WE00C% WP%	- -	C C	0 0	14 14	0 1
	A6	Stop compressor from external alarm	WE00S%, WE00C% e WP%	min	C	0	100	0
	A7	Digital alarm input delay	WE00S%, WE00C% e WP%	min	C	0	250	0
	A8	Enable alarms 'Ed1' and 'Ed2' (end defrost by timeout) 0: Alarm signals Ed1 and Ed2 enabled 1: Alarm signals Ed1 and Ed2 disabled	WE00S%, WE00C% e WP%	flag	C	0	1	0
	A9	Configuration of digital input 3 (ID3) As for /A2	WE00S%, WE00C% e WP%	-	C	0	14	0
	Ac	High condenser temperature alarm threshold	WE00S%, WE00C% e WP%	°C/°F	C	0.0	200	70
	AE	High condenser temperature alarm differential	WE00S%, WE00C% e WP%	°C/°F	C	0.1	20	10
	Acd	High condenser temperature alarm delay	WE00S%, WE00C% e WP%	min	C	0	250	0
	AF	Light sensor OFF time	WE00S%, WE00C% e WP%	s	C	0	250	0
	ALF	Antifreeze alarm threshold	WE00S%, WE00C% e WP%	°C/°F	C	-50	200	-5
	AdF	Antifreeze alarm delay	WE00S%, WE00C% e WP%	min	C	0	15	1

Symbol	Code	Parameter	Models	U-M.	Type	Min.	Max.	Def.																																																																																	
	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)	WE00C% e WP%	flag	C	0	2	0																																																																																	
	F1	Fan activation temperature (only if F0= 1 or 2)	WE00C% e WP%	°C/°F	F	-50	200	5																																																																																	
	F2	Evaporator fans with compressor OFF 0: see F0 1: always off	WE00C% e WP%	flag	C	0	1	1																																																																																	
	F3	Evaporator fans during defrost 0: Fans operate 1: Fans do not operate	WE00C% e WP%	flag	C	0	1	1																																																																																	
	Fd	Post dripping time (fans OFF)	WE00C% e WP%	min	F	0	15	1																																																																																	
	F4	Condenser fan stop temperature	WE00C% e WP%	°C/°F	C	-50	200	40																																																																																	
	F5	Condenser fan start differential	WE00C% e WP%	°C/°F	C	0.1	20	5																																																																																	
	H0	Serial address	WE00S%, WE00C% e WP%	-	C	0	207	1																																																																																	
	H1	AUX1 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	WE00C%	flag	C	0	13	1																																																																																	
			WP%	flag	C	0	13	3																																																																																	
	H2	Disable keypad/ir Parameter "H2" <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td></td> <td>LIGHT</td> <td>ON/OFF</td> <td>AUX</td> <td>HACCP</td> <td>PRG/MUTE (mute)</td> <td>UP/CC</td> <td>DOWN/DEF</td> <td>SET</td> <td>parameter F modification</td> <td>Set point modification</td> </tr> <tr> <td>0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>.</td> <td>.</td> </tr> <tr> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>.</td> <td>.</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>.</td> <td></td> <td></td> <td></td> <td></td> <td>.</td> <td>.</td> <td>.</td> <td>.</td> </tr> <tr> <td>5</td> <td>.</td> <td></td> <td></td> <td></td> <td></td> <td>.</td> <td>.</td> <td>.</td> <td>.</td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>.</td> <td>.</td> <td>.</td> <td>.</td> </tr> </table> Keypad function "." = Disabled		LIGHT	ON/OFF	AUX	HACCP	PRG/MUTE (mute)	UP/CC	DOWN/DEF	SET	parameter F modification	Set point modification	0								.	.	1										2								.	.	3										4	5	6						WE00S%, WE00C% e WP%	flag	C	0	6	1
				LIGHT	ON/OFF	AUX	HACCP	PRG/MUTE (mute)	UP/CC	DOWN/DEF	SET	parameter F modification	Set point modification																																																																												
			0								.	.																																																																													
			1																																																																																						
			2								.	.																																																																													
			3																																																																																						
			4																																																																													
	5																																																																															
	6																																																																																				
	H3	not user		-	C	0	255	0																																																																																	
	H4	Buzzer 0: enabled 1: disabled	WE00S%, WE00C% e WP%	flag	C	0	1	0																																																																																	
	H6	Terminal keypad lock configuration	WE00S%, WE00C% e WP%	-	C	0	255	0																																																																																	
H8	Output switched with scheduler 0: light 1: Aux	WE00S%, WE00C% e WP%	flag	C	0	1	0																																																																																		
H9	Set point variation with time band 0: Set point variation with time band disabled 1: Set point variation with time band enabled	WE00S%, WE00C% e WP%	flag	C	0	1	0																																																																																		
Hdh	Anti-sweat heater offset	WE00S%, WE00C% e WP%	°C/°F	C	-50	200	0																																																																																		
HAn	Number of HA alarms	WE00C2HC%	-	C	0	15	0																																																																																		
	HA...HA2	HA HACCP alarms activated (press Set)	WE00C2HC%	-	C	-	-	-																																																																																	
	y__	Year		years		0	99	0																																																																																	
	M__	Month		months		1	12	0																																																																																	
	d__	Day		days		1	7	0																																																																																	
	h__	Hour		hours		0	23	0																																																																																	
	n__	Minute		min.		0	59	0																																																																																	
	t__	Duration		hours		0	99	0																																																																																	
	HFn	Number of HF alarms	WE00C2HC%	-	C	0	15	0																																																																																	
	HF...HF2	Date/time of last HF event	WE00C2HC%	-	C		-	-																																																																																	
		y__	Year		years		0	99	0																																																																																
	M__	Month		months		1	12	0																																																																																	
	d__	Day		days		1	7	0																																																																																	
	h__	Hour		hours		0	23	0																																																																																	
	n__	Minute		min.		0	59	0																																																																																	
	t__	Duration		hours		0	99	0																																																																																	
	Htd	HACCP alarm delay	WE00C2HC%	min	C	0	250	0																																																																																	

Symbol	Code	Parameter	Models	U-M.	Type	Min.	Max.	Def.
	td1...8	Defrost 1...8 (press Set)	WE00C2HC%	-	C	-	-	-
	d__	Day		days		0	11	0
	h__	Hour		hours		0	23	0
	n__	Minute		min.		0	59	0
	ton	Light/aux on time	WE00C2HC%	-	C	-	-	-
	d__	Day		days		0	11	0
	h__	Hour		hours		0	23	0
	n__	Minute		min.		0	59	0
	toF	Light/aux off time	WE00C2HC%	-	C	-	-	-
	d__	Day		days		0	11	0
	h__	Hour		hours		0	23	0
	n__	Minute		min.		0	59	0
	tc	RTC date/time	WE00C2HC%	-		-	-	-
	y__	Year		years		0	99	0
	M__	Month		months		1	12	1
d__	Days of month		days		1	31	1	
u__	Days of week		days		1	7	6	
h__	Hours		hours		0	23	0	
n__	Minute		min.		0	59	0	

Tab. 7.a

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 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 1/2/3/4/5 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

Tab. 7.b

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

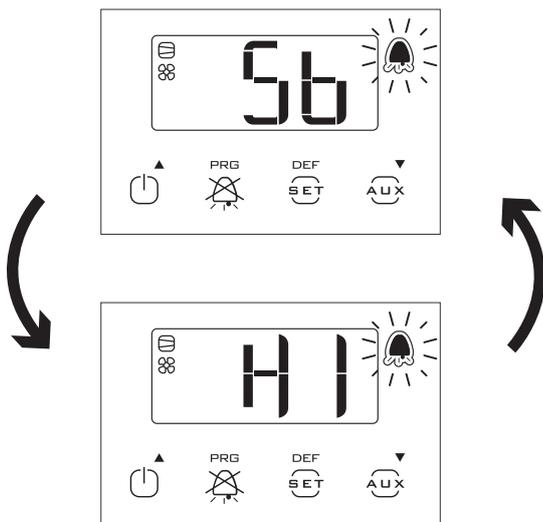
8.2 Alarms

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 outputs 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:

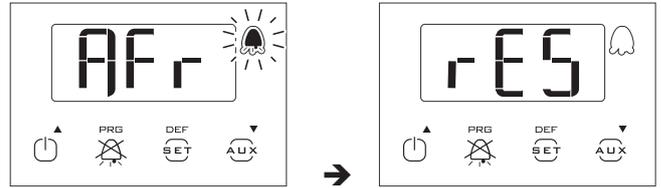


 Note: to mute the buzzer press Prg/mute.

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.

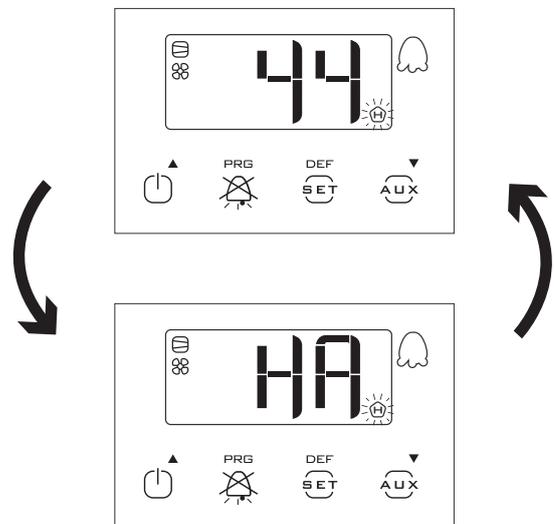
(HACCP = Hazard Analysis and Critical Control Point).

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 on ir33+ 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



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

8.4.1 Table of alarm signals

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		ON	ON	autom.	duty setting (c4)	duty setting (c4)	-	-	-	-	OFF	OFF	OFF	duty setting (c4)
E0	Probe S1 fault		OFF	OFF	autom.	duty setting (c4)	duty setting (c4)	-	-	-	-	OFF	OFF	OFF	duty setting (c4)
E1	Probe S2 fault		OFF	OFF	automatic	-	-	-	-	-	-	-	-	-	-
E2	Probe S3 fault		OFF	OFF	autom.	-	-	-	-	-	-	-	-	-	-
E3	Probe S4 fault		OFF	OFF	autom.	-	-	-	-	-	-	-	-	-	-
LO	Low temperature alarm		ON	ON	autom.	-	-	-	-	-	-	-	-	-	-
HI	High temperature alarm		ON	ON	autom.	-	-	-	-	-	-	-	OFF	OFF	-
AfR	Frost protection alarm		ON	ON	manual	OFF	OFF	-	-	-	-	-	-	-	OFF
IA	Immediate alarm from external contact		ON	ON	automatic	duty setting (A6)	duty setting (A6)	-	-	-	-	OFF	OFF	OFF	duty setting (A6)
dA	Delayed alarm from external contact		ON	ON	automatic	duty setting (A6)	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		ON	ON	automatic/manual	-	-	-	-	-	-	-	-	-	-
LP	Low pressure alarm		ON	ON	automatic/manual	OFF	OFF	-	-	-	-	-	-	-	OFF
AtS	Autostart in pump down		ON	ON	automatic/manual	-	-	-	-	-	-	-	-	-	-
cht	High condenser temp. pre-alarm		OFF	OFF	automatic/manual	-	-	-	-	-	-	-	-	-	-
CHt	High condenser temperature alarm		ON	ON	manual	OFF	OFF	-	-	-	-	-	OFF	OFF	OFF
dor	Door open for too long alarm		ON	ON	automatic	-	-	-	-	-	-	-	-	-	-
Etc	Real time clock fault		OFF	OFF	automatic	OFF	OFF	not run	OFF	OFF	not run	OFF	OFF	OFF	OFF
EE	Unit parameter EEPROM error		OFF	OFF	automatic	OFF	OFF	not run	OFF	OFF	not run	OFF	OFF	OFF	OFF
EF	Operating parameter EEPROM error		OFF	OFF	automatic	OFF	OFF	not run	OFF	OFF	not run	OFF	OFF	OFF	OFF
HA	Type of HA HACCP alarm		OFF	OFF	manual	-	-	-	-	-	-	-	-	-	-
HF	Type of HF HACCP alarm		OFF	OFF	manual	-	-	-	-	-	-	-	-	-	-
n1...n6	Indicates alarm on unit 1...6 in the network		ON	ON	automatic	-	-	-	-	-	-	-	-	-	-

Tab. 8.b

8.5 Alarm parameters

Alarm parameters and activation

AAL (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 be 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.

Par	Description	Def	Min	Max	UOM
A0	Alarm and fan differential	2.0	0.1	20.0	°C/°F
A1	Alarm thresholds (AL, AH) relative to set point or absolute 0/1=relative/absolute	0	0	1	-
AL	Low temperature alarm threshold If A1=0, AL=0: alarm disabled If A1=1, AL=-50: alarm disabled	0	-50.0	200	°C/°F
AH	High temperature alarm threshold If A1=0, AL=0: alarm disabled If A1=1, AL=200: alarm disabled	0	-50.0	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.

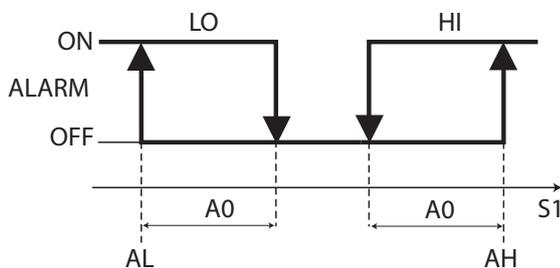


Fig. 8.a

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

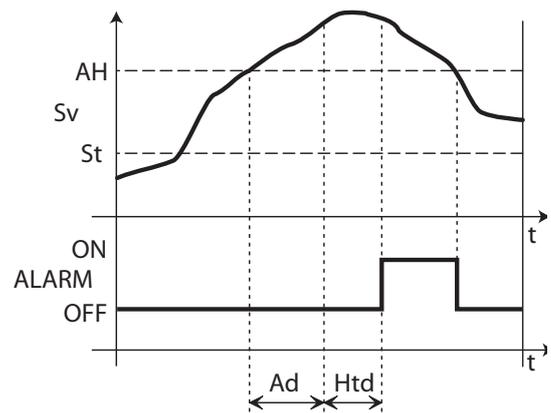


Fig. 8.b

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

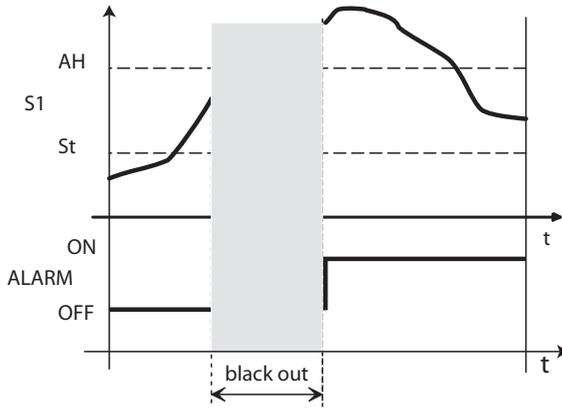


Fig. 8.c

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

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

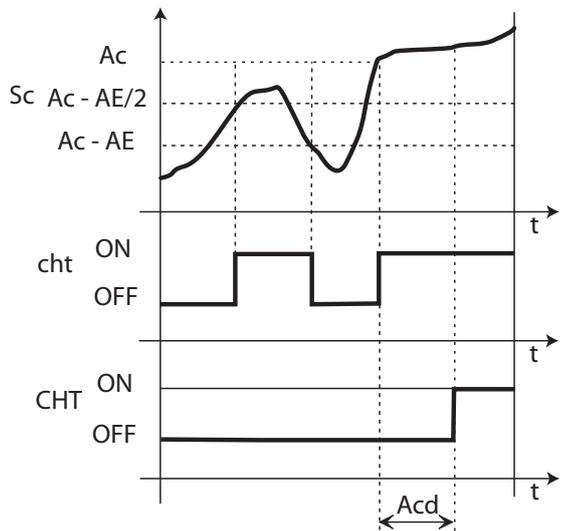


Fig. 8.d

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

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

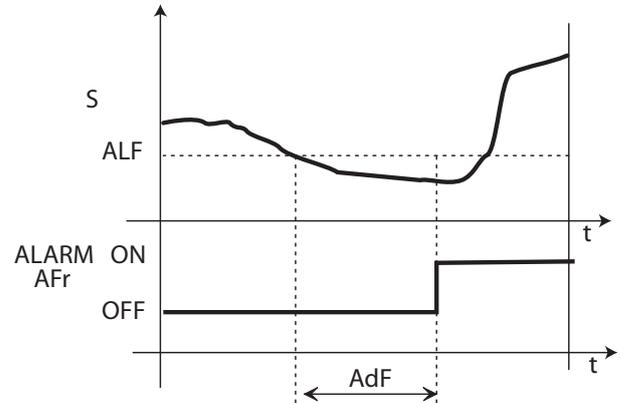


Fig. 8.e

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 Technical specifications

Single-phase version

Power supply	Model	Voltage	Power	
	E	230 V~ (+10%, -15%), 50/60 Hz	3 VA, 25 mA~ max.	
	A	115 V~, (+10%, -15%) 50/60 Hz	3 VA, 50 mA~ max.	
	H	115...230 V~ (+10%, -15%), 50/60 Hz	6 VA, 50 mA~ max.	
	L	12...24 V~ (+10%, -15%), 50/60 Hz, 12...30 Vdc	3 VA, 300 mA~ /mA _{dc} max.	
	0	12 V~, 50/60 Hz, 12...18 Vdc	Only use TRA12VDE00 fuse transformer in the late 315 mA delayed	
Insulation guaranteed by the power supply	E, A, H	insulation from extra low voltage parts insulation from relay outputs	reinforced, 6 mm clearance, 8 mm creepage, 3750V insulation basic, 3 mm clearance, 4 mm creepage, 1250V insulation	
	0, L	insulation from extra low voltage parts insulation from relay outputs	to be guaranteed externally by safety transformer (SELV) reinforced, 6 mm clearance, 8 mm creepage, 3750 V insulation	
Inputs	S1 (probe 1)	NTC		
	S2 (probe 2)	NTC		
	DI1 S3 (probe 3)	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA/ NTC		
	DI2 S4 (probe 4)	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA/ 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	10 kΩ a 25 °C, range -50T90 °C		
		measurement error:	1 °C in the range -50T50 °C 3 °C in the range 50T90 °C	
	High temperature NTC	50 kΩ a 25 °C, range -40T150 °C		
		measurement error:	1,5 °C in the range -20T115 °C 4 °C in the range outside of -20T115 °C	
Relay outputs	depending on the model			
		EN60730-1	UL873	
	relè	250 V~	operating cycles	250 V~
	8 A(*)	8(4)A on N.O. 6(4)A on N.C. 2(2)A on N.O. and N.C.	100000	8 A res. 2 FLA 12 LRA C300 30000
	16 (*)	10(4) A to 60 °C on N.O. 12(2)A on N.O. and N.C.	100000	12 A res. 5 FLA 30 LRA C300 30000
	2 Hp	10(10)A	100000	12 A res. 12 FLA 72 LRA C300 30000
(*) : 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.				
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 mm ² max current 12 A			
	connection type	section	Maximum current	
	fixed screw connectors	0,5 - 2,5 mq	12 A	
	removable connectors for screw blocks			
	conductor section for probes/digital inputs	0,5 - 2,5 mq	da 20 a 13 AWG	
	conductor section for power supplies/loads	0,5 - 2,5 mq	da 15 a 13 AWG	
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.				
Case	plastic	dimensions 128x290x101 mm		
Display	digit	3 digit LED		
	display	da -99 a 999		
	functioning mode	showned with graphic icons on display		
Keypad	4 buttons keypad membrane			
Buzzer	available on all models			
Operating temperature	models 0,L,H -10T50 °C		models E,A -10T45°C	
Operating humidity	<90% U.R. no condensing			
Storage temperature	-20T70 °C			
Storage humidity	<90% U.R. no condensing			
Front panel degree of protection	IP65 on the frontal			
Control pollution status	2 (in normal)			
PTI of insulating materials	plastic molds 250 plastic and insulating materials 175			
Period of stress across the insulating parts	long			
Heat and fire resistance category	category D e category B (UL 94-V0)			
Class of protection against voltage surge	category II			
Type of action and disconnection	1.B relay contact (micro-switching)			
Construction of control	Built-in, electronic			
Classification according to protection against electric shock	Class II, by suitable incorporation			
Device to be hand-held or incorporated into equipment intended to be manually held	no			
Software class and structure	classe A			
Frontal Cleaning of the controller	Use only neutral detergents and water.			
Serial interface CARELnetwork	extern. Available on all models, upon request			
Interface for per display repeater	extern. Available on models H, L, 0 upon request			
Maximum distance between interface and display	10 m			
Programming key	available on alls models			
Safety standards: compliant with relevant European standards				

Tab. 9.a

Three-phase version

Specifications		WP00B14A10	WP00B24A10	WP00B34A10	WP00B44A10	WP00B47B20	WP00B57B20
Power supply		400V 3~ +N+E 50/60Hz					
Max compressor power		5.5HP				7.5HP	
Protectors	Power	Disconnect switch 40A					
	Evaporator, condenser and defrost protection	Circuit breaker 10A				16A	
	Compressor protection	Adjustable motor protector 1.6-2.5A	2.5-4A	4-6.3A	6.3-10A		10-16A
	Auxiliary circuit protection	Circuit breaker 6A					
Inputs	Room temperature probe	ST1 NTC					
	Defrost probe	ST2 NTC					
	Door switch (or additional probe)	MS1	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA				
		S3 (probe 3)	NTC				
	Configurable digital input (or additional probe) *	DI3	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA				
			NTC				
	Safety thermostat	yes					
	Thermal overload evaporator fan	yes					
	Evaporator / condenser / defrost protection alarm	yes					
	Compressor / high pressure switch / compressor Kriwan protection alarm	yes					
Outputs	Evaporator fan	230V 1~+N+E 500W 2.5A AC3			400V 3~+N+E 2kW 3.3A AC3		
	Condenser fan	230V 1~+N+E 800W 3.9A AC3			230V 1~+N+E 800W 3.9A AC3		
	Defrost	400V 3~+T 6kW 9A AC1			400V 3~+T 9kW 13A AC1		
	Light (or AUX, configurable)	230V 1~+N+E 800W 3.9A AC3			230V 1~+N+E 800W 3.9A AC3		
	Solenoid valve	yes					
	Compressor oil heater	yes					

Tab. 9.b

* To be connected directly to terminals 11 and 12 on the electronic board.

Casing	plastic, dimensions 491x380x168
Materials	polycarbonate cover, technopolymer shell
Display	digits, 3 digit LED
	display, from -99 to 999
	operating status indicated by graphic icons on display status of loads signalled by LEDs on the panel
Keypad	4-button membrane keypad
Buzzer	available on all models
Serial interface	external. Available on all models on request
Repeater display interface	external. Available on all models on request
Maximum distance between interface and display	10 m
Programming key	Available on all models on request
Op. temp.	-10T50 °C
Op. humidity	<90% RH non-condensing
Storage temp.	-20T70 °C
Storage humidity	<90% RH non-condensing
Front panel ingress protection	IP56
Cleaning front panel of the device	only use neutral detergents and water
Safety standards	compliant with relevant European standards

Tab. 9.c

9.2 SmartCella 3PH wiring diagrams

9.2.1 Power circuit (WP00B44A10, WP00B34A10, WP00B24A10, WP00B14A10)

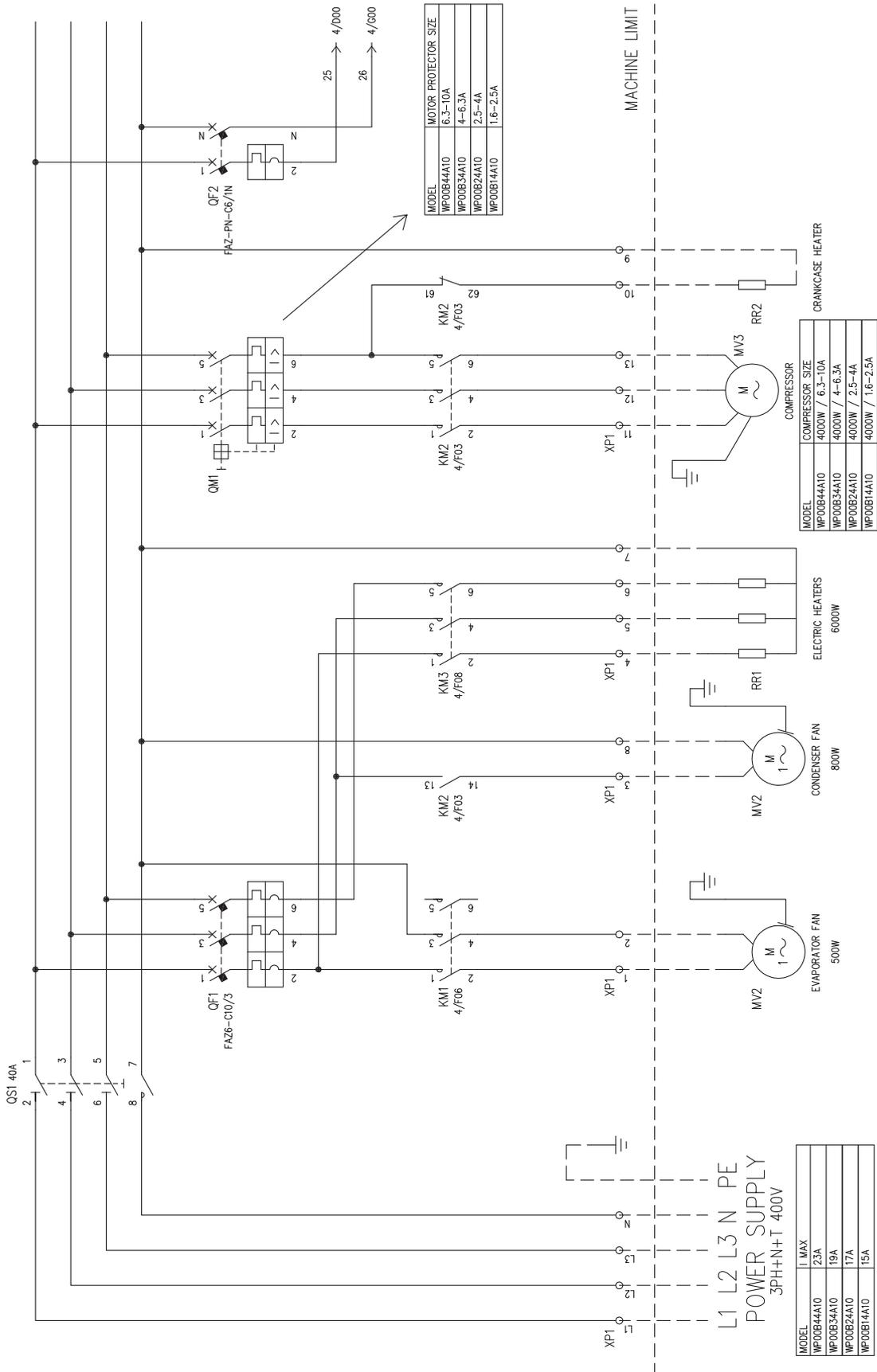


Fig. 9.a

9.2.2 Power circuit (WP00B57B20, WP00B47B20)

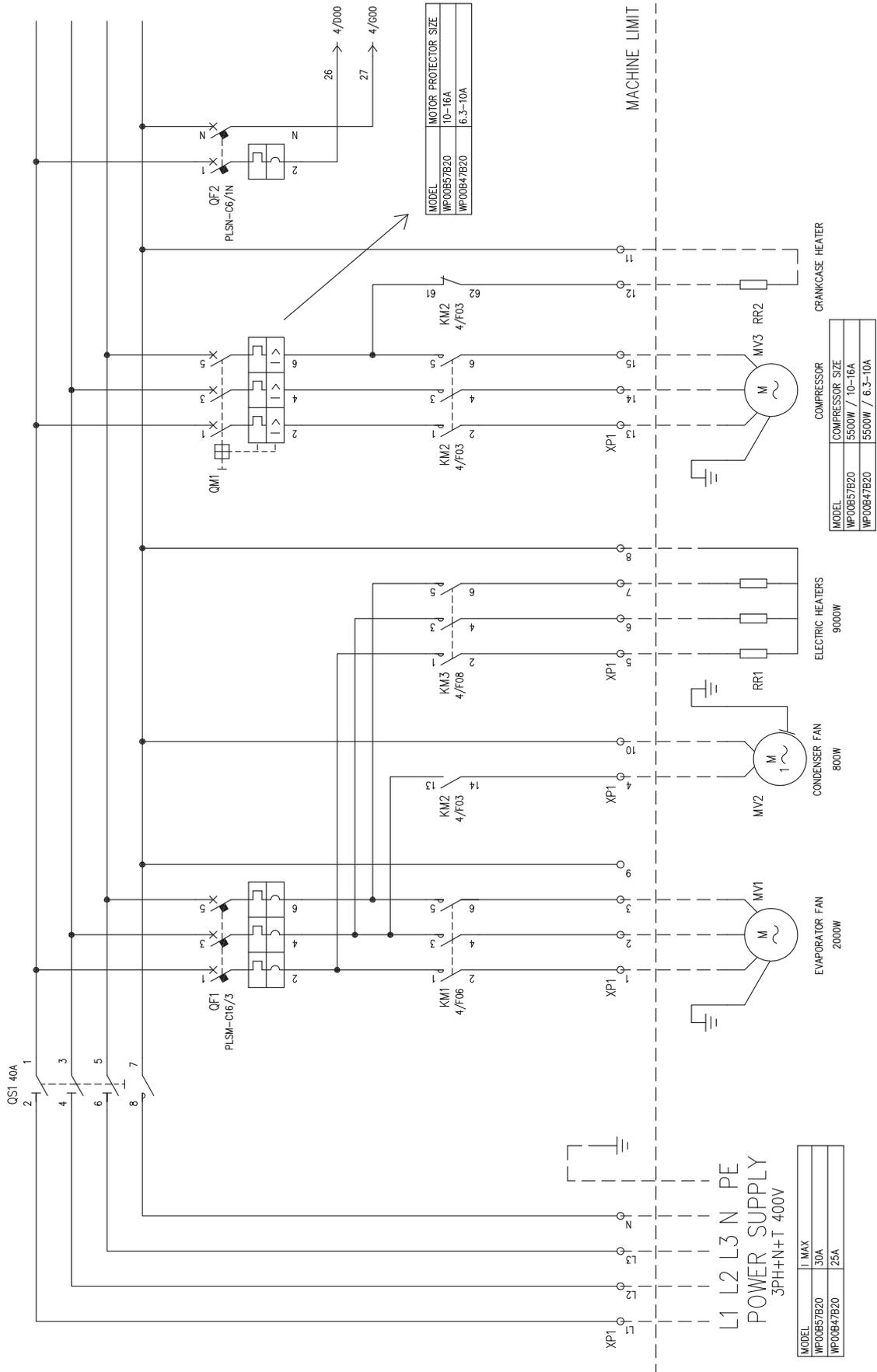


Fig.9.b

9.2.3 Auxiliary circuit

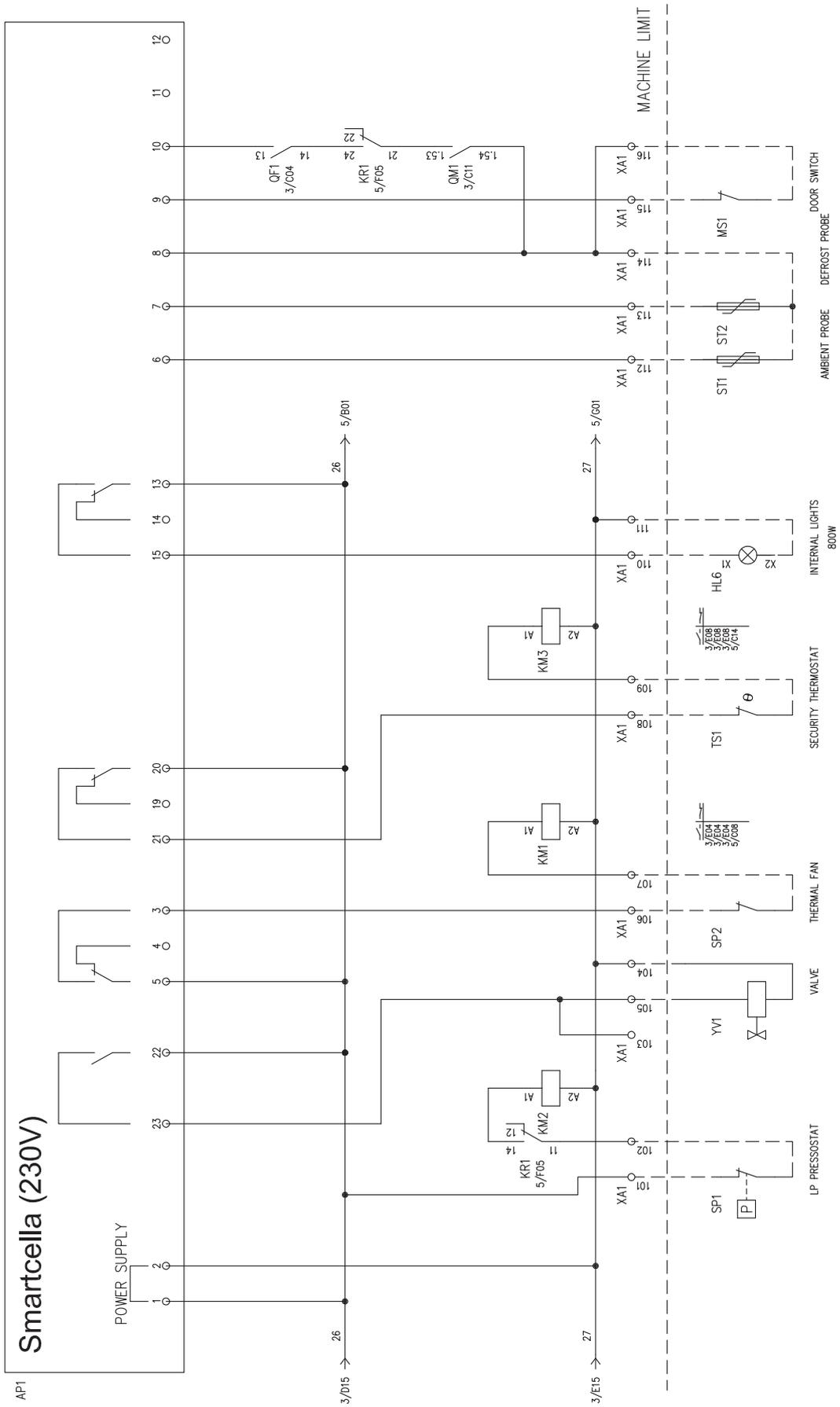


Fig. 9.c

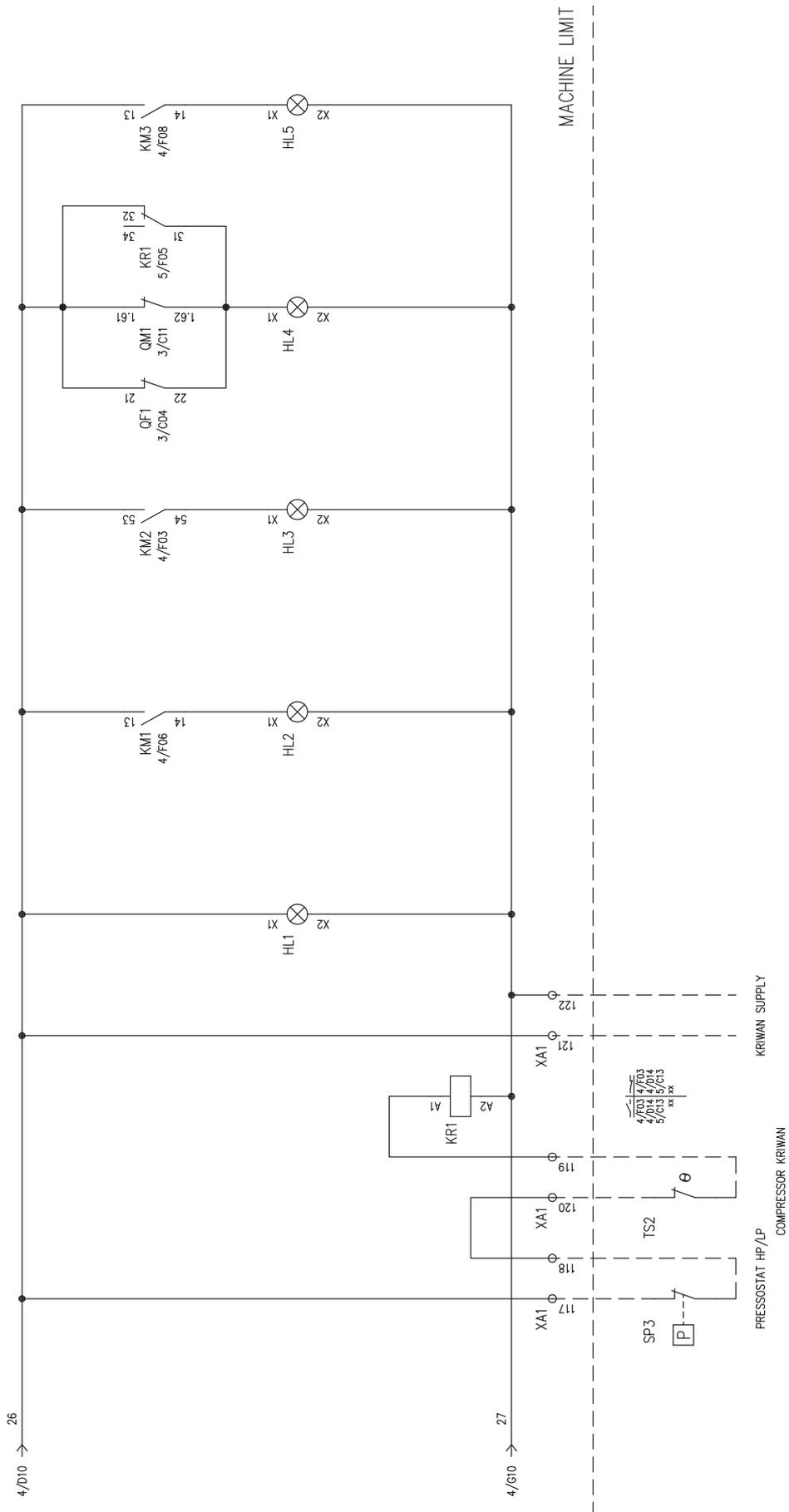


Fig. 9.d

9.3 Connections for pump down operation managed by Smartcella

9.3.1 Connections for pump down by pressure with compressor shutdown due to low pressure

If pump down is controlled based on pressure, using a pressure switch, with compressor shutdown due to low pressure, the connections are as shown in the following diagram

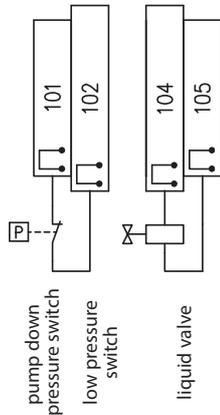


Fig. 9.e

In this configuration, when there is no cooling request ($S_v < S_t$) the solenoid valve relay (terminals 105-104) opens, while the compressor (KM2) remains on until the pressure switch measures low pressure (terminals 101-102)

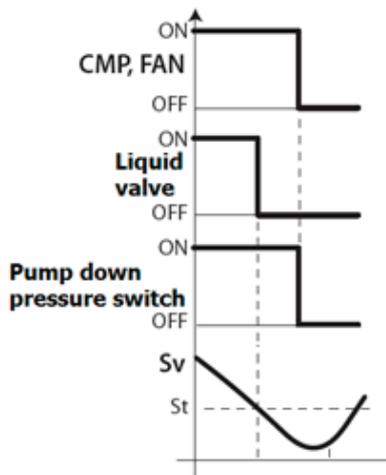


Fig. 9.f

Note: as the pressure switch is connected to terminals 101-102, do not enable pump down on Smartcella 3PH (check that $c7=0, H1 \neq 5$).

9.3.2 Connections for pump down by pressure with simultaneous compressor and solenoid valve activation

If pump down is controlled based on pressure, with simultaneous compressor and solenoid valve activation, the connections are as shown in the following diagram

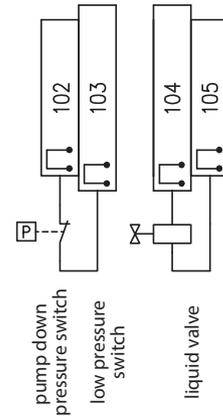


Fig. 9.g

In this configuration, when there is no cooling request ($S_v < S_t$) the solenoid valve (terminals 105-104) and the compressor (KM2) are deactivated simultaneously. In normal operation, when the pressure switch measures low pressure, the compressor is also shutdown

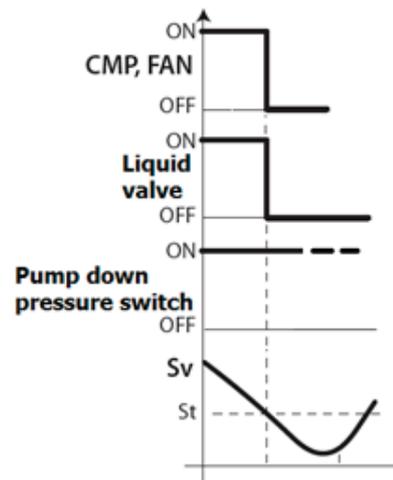


Fig. 9.h

Note: do not enable pump down on Smartcella 3PH (check that $c7=0, H1 \neq 5$).

9.3.3 Connections for simultaneous compressor and solenoid valve activation

If shutdown simultaneous compressor and solenoid valve activation and deactivation are required, without using a pressure switch, the connections are as shown in the following diagram

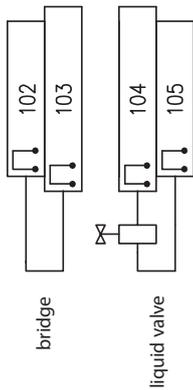


Fig. 9.i

In this configuration, when there is no cooling request ($Sv < St$), the deactivated valve (terminals 105-104) and the compressor (KM2) are off simultaneously

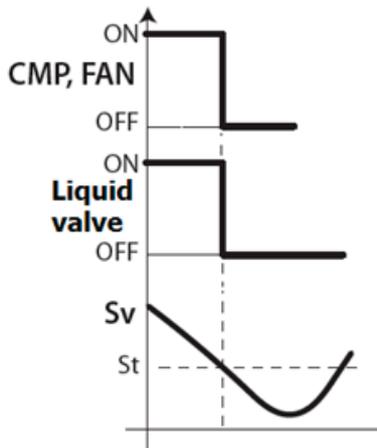


Fig. 9.j

Note: do not enable pump down on Smartcella 3PH (check that $c7=0$, $H1 \neq 5$).

9.3.4 Connections for pump down by time

If solenoid valve needs to be activated and deactivated by time, without using a pressure switch, the connections are as shown in the following diagram

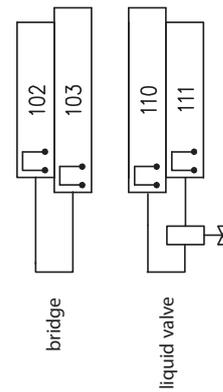


Fig. 9.k

On Smartcella 3PH configure:

- H1=5 (aux1 output, terminals 110-111, for pump down valve)
- C10=1 (pump down by time)
- C7>0 (pump down time)

In this configuration, when there is no cooling request ($Sv < St$), the solenoid valve relay (terminals 110-111, AUX1 output on Smartcella) opens, while the compressor (KM2) operates for the time defined by parameter C7

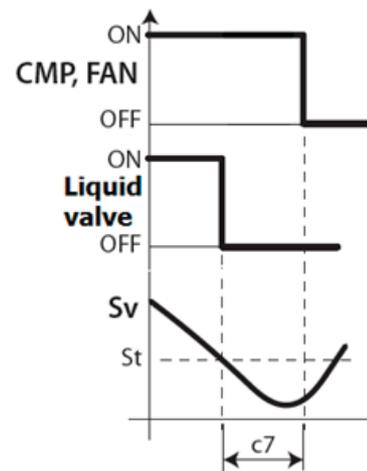


Fig. 9.l

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.

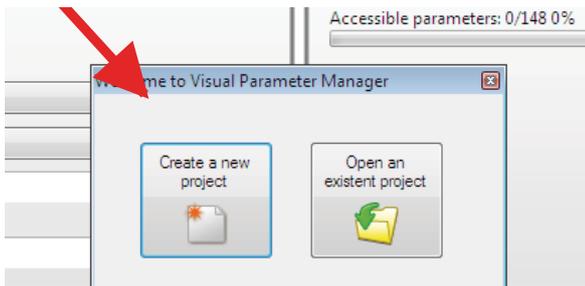


Fig. 10.a

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);

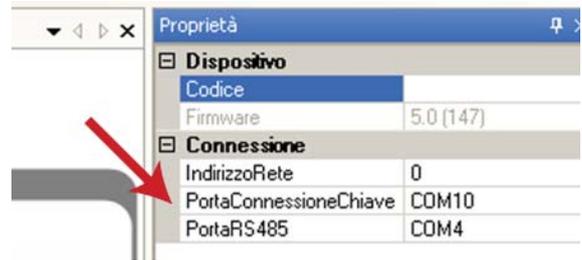


Fig. 10.c

- 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



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

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: 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;

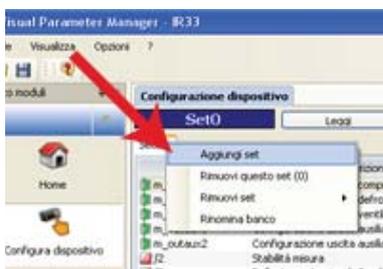


Fig. 10.i

- Set1 is displayed



Fig. 10.j

11. APPENDIX 2: ADVANCED FUNCTIONS

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 dl				
	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 dl	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	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

11.8 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 "dl" is adjusted by the value "Δdl", calculated using the algorithm.

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

11.9 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 Probe 3	Evap. 1 Evap. 2	Probe 1 acts on evap. 1 Probe 2 acts on evap. 2
6	Probe 2 Probe 4	Evap. 1	Probe 2 and 4 act on evap. 1 (end defrost if all probes > end defrost threshold.)
	Probe 3 Probe 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.

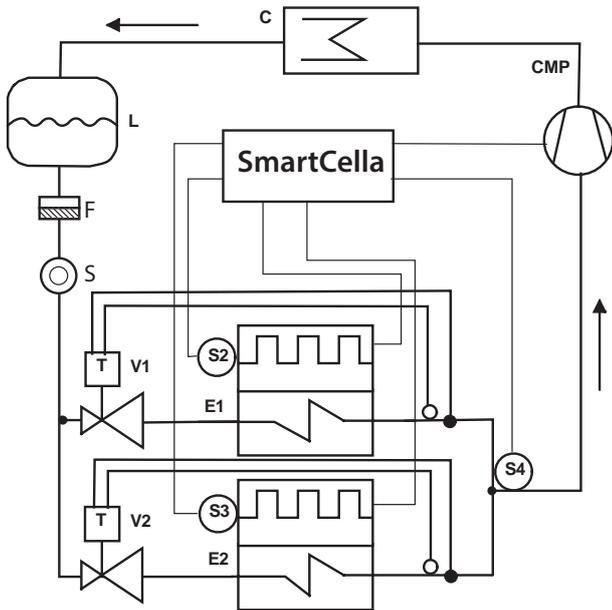


Fig. 11.a

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

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	Defrost ends by timeout (dP1)
	AUX1 configured	Defrost ends by timeout (dP1)
	AUX2 configured	Defrost ends by timeout (dP2)
	AUX1 and AUX2 not configured	Not performed
Probe 4 together with probe 2 and probe 3 defrost output 1 and defrost output 2	Probe available, probe error	Defrost ends by timeout (dP2)
	Probe available and AUX1 and AUX2 not configured	Defrost performed on defrost output
Probe 4 together with probe 2 and probe 3 defrost output 1 and defrost output 2	No probe, not managed	Cases 4, 6 not recognised
	Probe available, probe error	Defrost ends by timeout error

Tab. 11.d

DEFROST BY TIME

Defrost probe / evap. output config.	Situation	Effect
Defrost output 1	AUX1 configured	Defrost ends by timeout (dP1)
	AUX2 configured	Defrost ends by timeout (dP2)
	AUX1 and AUX2 not configured	Defrost not performed
	AUX1 and AUX2 not configured	Defrost not performed

Tab. 11.e

Note: AUX1 and AUX 2 configured as evaporator outputs are not equivalent.

11.10 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/H5	AUX/AUX2 output configuration	1/3	0	13	-
	0 = normally energised alarm				
	...				
	13 = second compressor step with rotation				

Tab. 11.f

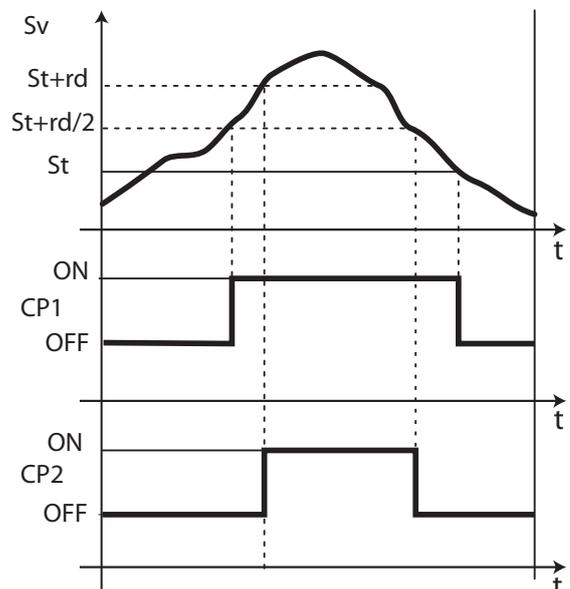


Fig. 11.b

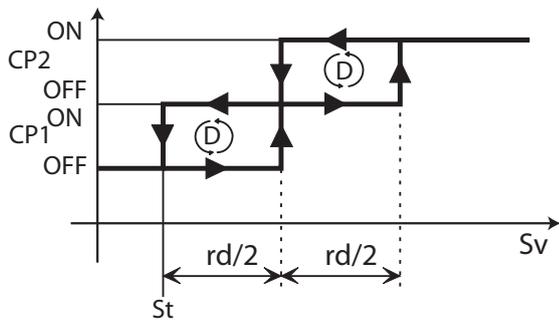


Fig. 11.c

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

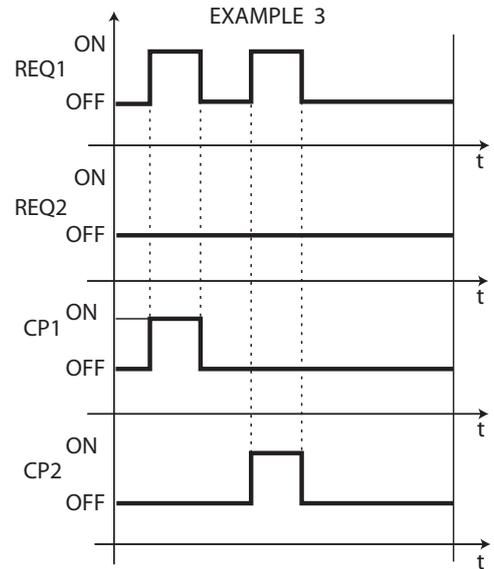


Fig. 11.f

Examples of operation:

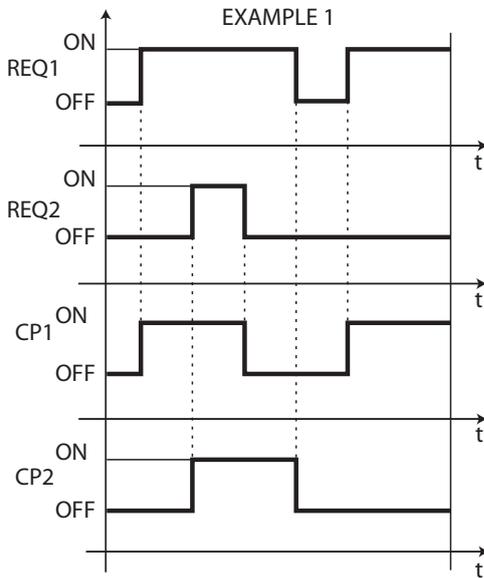


Fig. 11.d

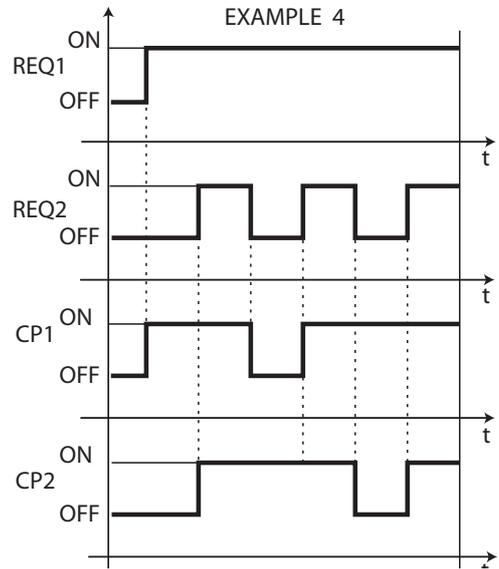


Fig. 11.g

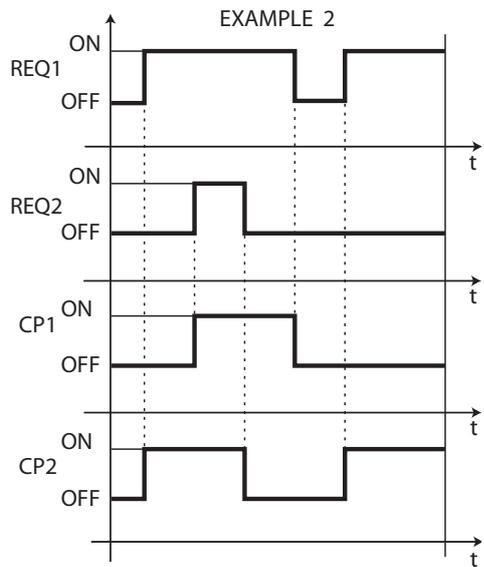


Fig. 11.e

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

CAREL

CAREL INDUSTRIES S.p.A.

Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)

Tel. (+39) 049.9716611 - Fax (+39) 049.9716600

e-mail: carel@carel.com - www.carel.com

Agenzia / Agency: