ENG

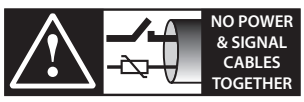
MPXzero

Electronic controller for refrigeration applications

USER MANUAL

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS



READ CAREFULLY IN THE TEXT!

MPXone

+0300106EN - ENG

Up to date version available on

www.carel.com

GENERAL WARNINGS

CAREL bases the development of its products on decades of experience in HVAC, on 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/affiliates 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 successful 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. 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. 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 cards, 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/affiliates 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/affiliates are warned of the possibility of such damage.

DISPOSAL

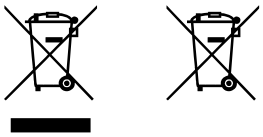


Fig. 1 Fig. 2

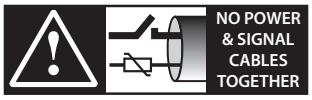
INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

The product is made up of metal parts and plastic parts. In reference to European Union directive 2002/96/EC issued on 27 January 2003 and 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 technical leaflet 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 materials: 2 years (from production date, excluding consumables).

Approval: the quality and safety of CAREL S.p.A. products are guaranteed by the ISO 9001 certified design and production system.



READ CAREFULLY IN THE TEXT!

Separate as much as possible the probe and digital input cables from cables to inductive loads and power cables, so as to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel cables) and signal cables in the same conduits.

Key to the symbols:

Important: to bring critical issues to the attention of those using the product.

Notice: to focus attention on important topics; in particular the practical application of the various product functions.

Important: this product is to be integrated and/or incorporated into the final apparatus or equipment. Verification of conformity to the laws and technical standards in force in the country where the final apparatus or equipment will be operated is the manufacturer's responsibility. Before delivering the product, Carel has already completed the checks and tests required by the relevant European directives and harmonised standards, using a typical test setup, which however cannot be considered as representing all possible conditions of the final installation.

HACCP: CAUTION

Food Safety programs based on procedures such as HACCP and, more generally, certain national regulations, require that the devices used for food storage be periodically checked to ensure that measurement errors are within the limits allowed for the application used. Carel recommends users to follow, for example, the indications of the European standard "Temperature recorders and thermometers for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream - PERIODIC VERIFICATION", EN 13486 - 2001 (or subsequent updates) or similar regulations and provisions in force in the country in question. Further information can be found in the manual regarding the technical characteristics, correct installation and configuration of the product.

Index

1. INTRODUCTION

MPXzero is a range of electronic controllers for centralised food retail refrigeration applications The user terminal, with capacitive touch screen, features wireless connectivity with mobile devices. The range includes two versions, standard and advanced, which differ in terms of the number of inputs/outputs, the number of serial ports available (Fieldbus) and wireless connectivity. Near Field Connection (NFC) is always available, while Bluetooth (BLE) is optional on the Advanced version. The power supply is always 115-230 Vac.
The CAREL "APPLICA" app is available on Google Play for the Android operating system and on the Apple Store for iOS (Bluetooth only). This simplifies parameter configuration and unit commissioning in the field (also available in Desktop mode). The following tools complete the solution:

- "Spark" PC commissioning tool, used to manage user profiles, configure parameters and change descriptions of the variables. The possibility to use these two tools simultaneously, even by different users in separate locations - for example, modify a user profile with "Spark" in the technical office, and apply it to the system using "Applica", highlights the potential made available by the complete package;
- "Sparkly" command-line production line tool, which, also via the RS485 serial port, is used in production systems for configuring the devices (unit parameters or information) and end-of-line testing.

1.1 Functions and main features

MPXzero, which shares many of the features already available on the MPXone range of controllers, has been designed to offer maximum flexibility thanks to modular hardware. The advanced version, compared to the standard version:

- has a higher number of digital outputs;
- with the built-in Fieldbus port allows management via serial of a VCC compressor (Secop/Embraco specifications) or alternatively the control of Main/Secondary local networks.

The functions assigned to the various analogue inputs are those for controlling the refrigerated cabinet temperature - outlet, intake and defrost probe - while the software features can be used to configure the probes for different purposes, such as defrost temperature for the second evaporator or an auxiliary temperature. In addition, up to four virtual probes are available, physically connected to other devices and shared via the supervisor, and can be used to manage one of the specific functions listed above. The two analogue outputs, when available on the advanced model, can be used to control the speed of a VCC compressor ion frequency mode (PWM), or the speed of the evaporator fans and/or to modulate the anti-sweat heaters. The digital inputs can be used for day/night switching, defrost calls, the door or curtain switch or activating alarms and other special functions. The digital outputs (up to 4 relays) can be configured to control activation of the solenoid valve/compressor, evaporator fans, defrost, lights and/or alarms.

Main features:

- compact structure: panel mounting;
- 115/230Vac power supply;
- hardware equipped with two 0-10 V modulating outputs for managing anti-sweat heaters and evaporator fans (MPXzero advanced version with VCC by frequency only);
- NFC wireless connectivity as standard (Bluetooth optional on the advanced version);
- commissioning tool to optimise configuration of the controller;
- possibility to control a VCC compressor in serial or frequency mode, to Secop/Embraco specifications, advanced version only;
- possibility to configure a Main/Secondary network (up to 6 cabinets, advanced version without VCC only);
- built-in RS485 serial port for connection to supervisors and remote service systems (CAREL or Modbus protocol);
- defrost activated via keypad, digital input, network signal from Main, supervisor or scheduled with built-in RTC;
- management of various types of defrosts, on one or two evaporators: heater, natural (compressor off);
- smart defrost functions;
- coordination of network defrosts;
- management of cabinet lights and curtain;
- digital input broadcast from Main to Secondary devices;
- display Secondary alarms on Main;
- share one or more network probes;
- Main gateway to supervisor for all Secondary devices;
- HACCP alarm management.

1.2 Models and accessories

The single-pack versions come with connector kits. The table below shows the list of part numbers and distinctive features for the standard and advanced versions.

Fig. 1.a

P/N	Description
S0MPSS3R02S0333	MPXzero, Standard, 115/230V, 3 relays, BMS, NFC, with connectors, single pack
S0MPSA4R03SA000	MPXzero, Advanced, 115/230V, 4 relays, BMS+Fbus, NFC, with connectors, single pack
S0MPSA4B03S0274	MPXzero, Advanced, 115/230V, 4 relays, BMS+Fbus, NFC, Bluetooth, with connectors, single pack
S0MPSA4R06S0319	MPXzero, Advanced, 115/230V, 4 relays, BMS, VCC frequency / 2 analogue outputs, NFC, with connectors, single pack
S0MPSA4B04S0320	MPXzero, Advanced, 115/230V, 4 relays, BMS, VCC serial, NFC, Bluetooth, with connectors, single pack

1.2.1 User terminal

The built-in user terminal includes the display and keypad, comprising four buttons that, when pressed alone or combined with other buttons, are used to display and set the controller's parameters (see "User interface"). Connectivity - NFC or NFC + Bluetooth (BLE) based on the model - allows interaction with mobile devices and simplifies unit commissioning (after having installed the CAREL "Applica" APP for the Android/IOS operating systems).

1.2.2 Accessories

Notice: this list of ACCESSORY part numbers is updated as of the release date of this manual; please contact CAREL for any additional part numbers available.

Notice: connectors and brackets are always included with the single packs!

Connector kit

Fig. 1.b

P/N	Description
BXOPZB35002B1	plug-in connector kit, 2 pins, 3.5 mm pitch, black (10 pcs)
BXOPZB35003B1	plug-in connector kit, 3 pins, 3.5 mm pitch, black (10 pcs)
BXOPZB38102G1	plug-in connector kit, 2 pins, 3.81 mm pitch, green (10 pcs)
BXOPZB38104G1	plug-in connector kit, 4 pins, 3.81 mm pitch, green (10 pcs)
BXOPZB38105G1	plug-in connector kit, 5 pins, 3.81 mm pitch, green (10 pcs)
BXOPZB50802O1	plug-in connector kit, 2 pins, 5.08 mm pitch, orange (10 pcs)
BXOPZB50803G1	plug-in connector kit, 3 pins, 5.08 mm pitch, green (10 pcs)
BXOPZB50805G1	plug-in connector kit, 5 pins, 5.08 mm pitch, green (10 pcs)
BXOPZB50807G1	plug-in connector kit, 7 pins, 5.08 mm pitch, green (10 pcs)

Tab. 1.a

Fixing brackets

Fig. 1.c

P/N	Description
BXOPZMBRC0002	bracket kit for panel version, multiple pack (20 pcs)

Tab. 1.b

Cables

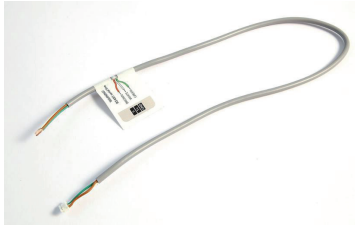


Fig. 1.d

P/N	Description
BXOPZC3000050	3-pin mini JST/free end cable, 50 cm (1 pc)
BXOPZC3S00250	3-pin mini JST/free end shielded cable, 250 cm (1 pc)
BXOPZC4000150	4-pin mini JST/mini JST cable, 150 cm (1 pc)
BXOPZC4000300	4-pin mini JST/mini JST cable, 300 cm (1 pc)
BXOPZC4010300	Multipurpose 4-pin mini JST/free end cable (VCC freq / AO / HMI display) 300 cm 1 pc.
BXOPZC3000050	Multipurpose 4-pin mini JST/free end cable (FBS, VCC serial) 300 cm 1 pc.
BXOPZC3S00250	Multipurpose 4-pin mini JST/free end shielded cable (FBS, VCC serial) 250 cm 1 pc.
BXOPZC30E010*	Plug & play serial cable for Embraco inverters. 3-wire cable, with mini JST connector at one end and Embraco inverter connector at the other
BXOPZC30E010*	Plug & play serial cable for Secop inverters. 3-wire cable, with mini JST connector at one end and Secop inverter connector at the other

Tab. 1.c

Adapter kits

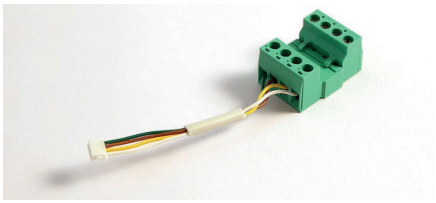


Fig. 1.e

P/N	Description
BXOPZC4020010	4-pin mini JST/removable cable adapter, 10 cm (1 pc)

Tab. 1.d

Converters

Fig. 1.f

P/N	Description
CVSTDUMOR0	USB/RS485 converter

Tab. 1.e

1.2.3 Temperature sensors

CAREL offers probes that are designed to facilitate installation:

Fig. 1.g

P/N	Type	Description	Range
NTC***HP0*	10 kΩ±1%@25 °C, IP67, β 3435	Cabinet ambient temperature probe	-50 to 50 °C (105°C in air)
PT1060HP01	PT1000 Class B, IP67	Temperature probe	-50T105°C in air

Tab. 1.f

Notice: see manual +040010025 (ITA- ENG) /+040010026 (FRE-GER) for guidelines on installing the sensors on the unit.

Installation example with one evaporator

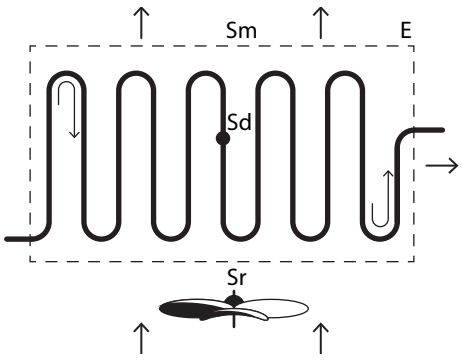


Fig. 1.h

Key:

Code	Description
Sm	Outlet probe
Sr	Intake probe
Sd	Defrost probe
E	Evaporator

Tab. 1.g

1.2.4 USB/RS485 converter (CVSTDUMOR0)

Fig. 1.i

Electronic device used to interface an RS485 network to a personal computer via the USB port. See technical leaflet +050000590.
The image below shows a connection example.

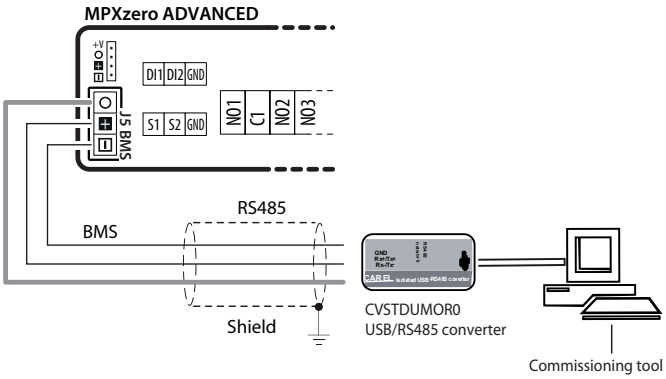


Fig. 1.j

2. INSTALLATION

2.1 Warnings

⚠ **Important:** avoid installing the controller in environments with the following characteristics:

- temperature and humidity that do not comply with the ambient operating conditions (see "Technical specifications");
- strong vibrations or knocks;
- exposure to water sprays or condensate;
- exposure to aggressive and polluting atmospheres (e.g.: sulphur and ammonia gases, saline mist, smoke) which may cause corrosion and/or oxidation;
- strong magnetic and/or radio frequency interference (thus avoid installation near transmitting antennae);
- exposure to direct sunlight and the elements in general;
- wide and rapid fluctuations in ambient temperature;
- exposure of the controller to dust (formation of corrosive patina with possible oxidation and reduction of insulation);

2.2 Panel version

2.2.1 Dimensions mm (inch)

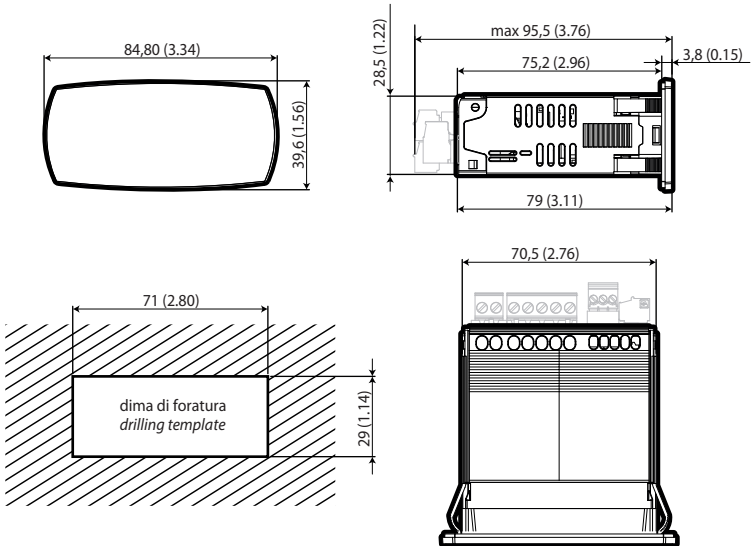


Fig. 2.a

2.2.2 Assembly

⚠ **Important**: before carrying out any maintenance, disconnect the controller from the power supply by moving the Main system switch to "off".

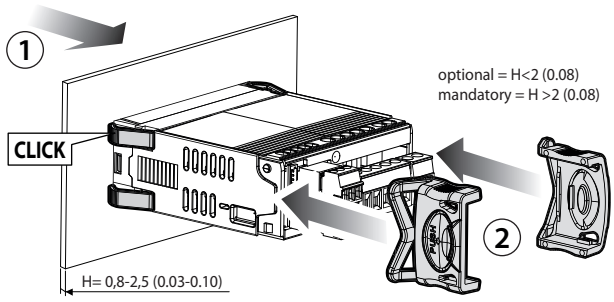


Fig. 2.b

1. Place the controller in the opening, pressing lightly on the side anchoring tabs.
2. Then press on the front until fully inserted (the side tabs will bend, and the catches will attach the controller to the panel, up to a maximum thickness of 2 mm).
3. If necessary, fit the fixing brackets.

Important: IP65 front protection is guaranteed only if the following conditions are met:
- maximum deviation of the rectangular opening from flat surface: ≤ 0.5 mm (0.02 in);
- thickness of the electrical panel sheet metal: 0.8-2 mm (0.03-0.1 in); for thicknesses from 2-2.5 mm (0.08-0.1 in), the optional fixing brackets are required;
- maximum roughness of the surface where the gasket is applied: ≤ 120 µm.

Notice: the thickness of the sheet metal (or material) used to make the electrical panel must be adequate to ensure safe and stable mounting of the product.

2.2.3 Removal

Important: before carrying out any maintenance, disconnect the controller from the power supply by moving the Main system switch to "off".

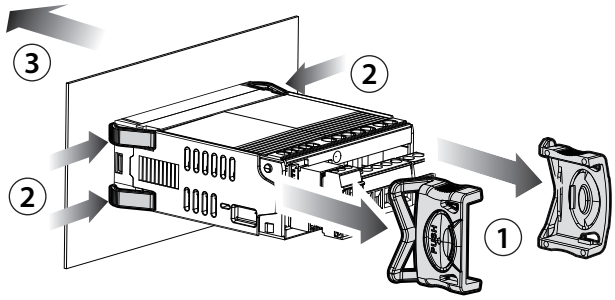


Fig. 2.c

Open the electrical panel and from the rear:
1. remove the fixing brackets (if fitted);
2. gently press the side anchoring tabs on the controller;
3. exert slight pressure on the controller until it is removed.

Important: the operation does not require the use of a screwdriver or other tools.

2.3 Description of the terminals

MPXzero STANDARD

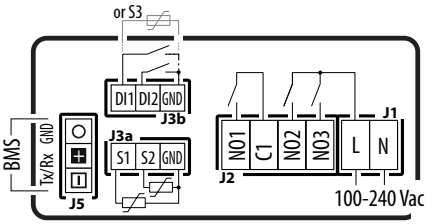


Fig. 2.d

MPXzero ADVANCED

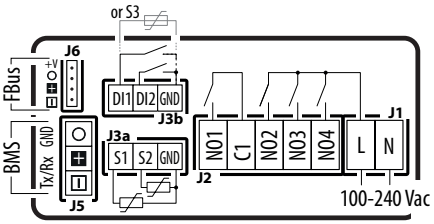


Fig. 2.e

VCC Serial mode

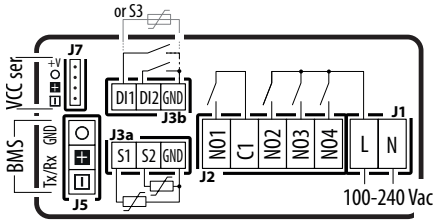


Fig. 2.f

VCC Frequency mode

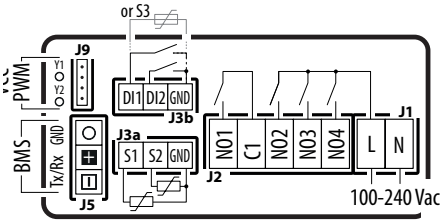


Fig. 2.g

Ref.		Description
J1	L	Power supply
	N	
J2	NO1	Digital output (relay) 1
	C1	Common for relay 1
	NO2	Digital output (relay) 2
	NO3	Digital output (relay) 3
	NO4	Digital output (relay) 4
J3a	S1	Analogue input 1 (NTC, PT1000)
	S2	Analogue input 2 (NTC, PT1000)
	GND	Analogue inputs 1,2 GND
J3b	DI1	Digital input 1 (or analogue input 3)
	DI2	Digital input 2
	GND	Digital input 1, 2 GND
J5	-	BMS serial port (RS485): Rx-/Tx-
	+	BMS serial port (RS485): Rx+/Tx+
	O	BMS serial port (RS485): GND

Ref.		Description
J6	-	Fieldbus serial port (RS485) / VCC serial: Rx-/Tx-
	+	Fieldbus serial port (RS485) / VCC serial: Rx/Tx + / Y2 for VCC frequency version
	O	Fieldbus serial port (RS485) / VCC serial: GND
	+V	Fieldbus serial port (RS485): +V
J7	-	VCC serial port Rx/Tx -
	+	VCC serial port Rx/Tx +
	O	VCC serial port GND
J9	Y1	Analogue output 1
	O	GND: analogue output reference
	Y2	Analogue output 2
	O	GND: analogue output reference

Tab. 2.a

2.4 Probe connections

Notice:

- the probe connections relate to the default parameter configuration;
- probes S1, S2, S3 can be configured as NTC or PT1000;
- the temperature probes must all be the same type.

MPXzero ADVANCED (3xNTC)

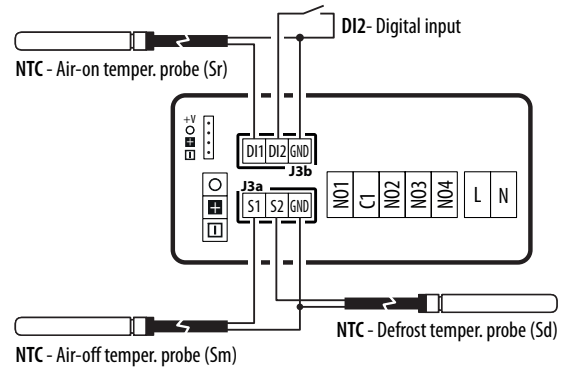


Fig. 2.h

MPXzero ADVANCED (2xNTC, 1xDI)

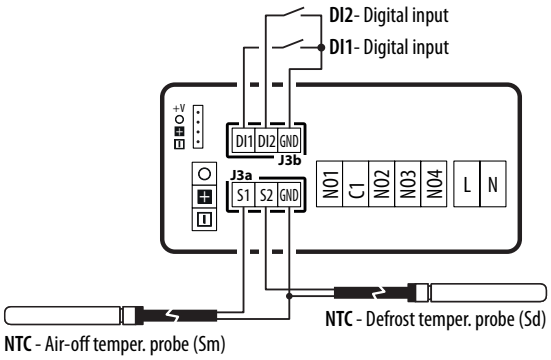
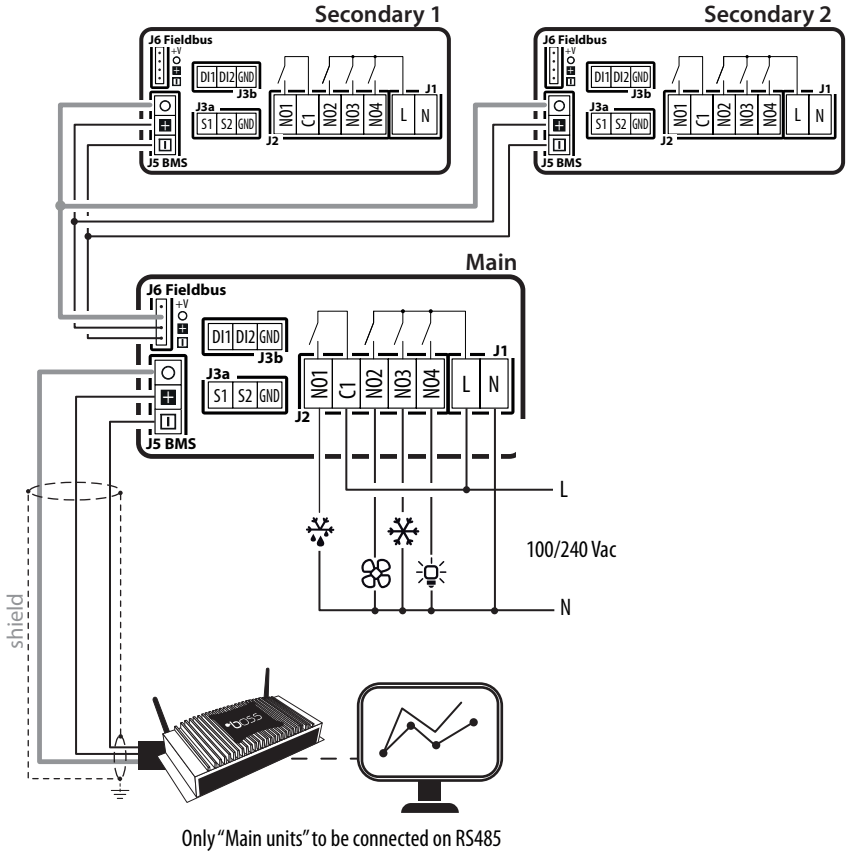


Fig. 2.i

2.5 Connection diagrams

Notice: the "APPLICA" app can be used to change the configuration of the probes without needing to rewire or change the functions of the relays, thus taking advantage of different capacities when needed.

2.5.1 Advanced model



Only "Main units" to be connected on RS485

Fig. 2.j

2.5.2 Advanced VCC version

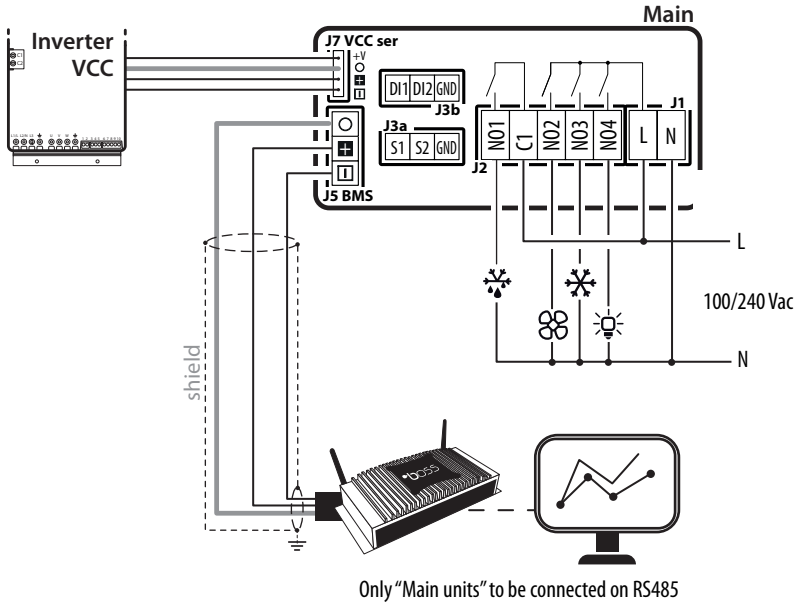


Fig. 2.k

2.5.3 Advanced VCC frequency version

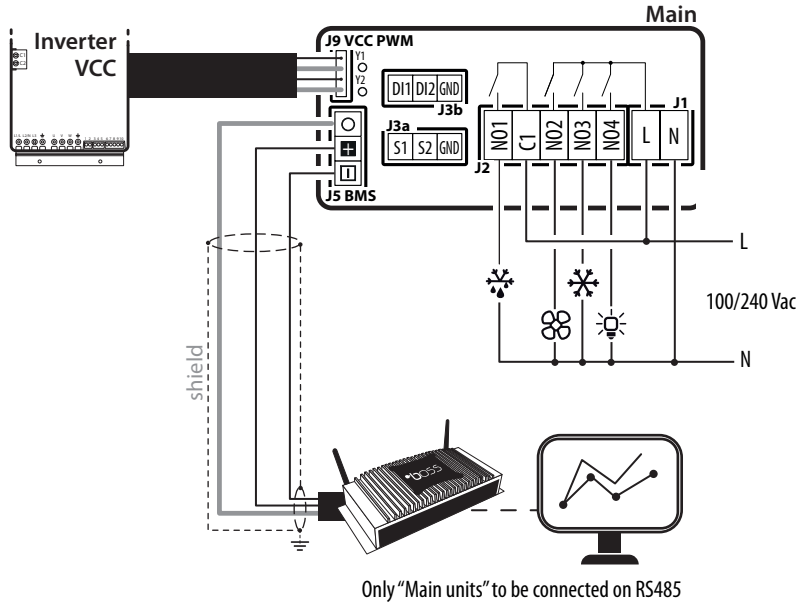


Fig. 2.l

Notice: the MPXzero Advanced VCC frequency version, on the output not used to control the variable speed compressor, can configure outputs Y1 and/or Y2 for managing modulating functions, such as variable speed fans or anti-sweat heaters .

2.6 Positioning inside the panel

The position of the controller in the electrical cabinet must be chosen so as to guarantee correct physical separation from the power components (solenoids, contactors, actuators, inverters, ...) and the connected cables. Proximity to such devices/cables may create random malfunctions that are not immediately evident. The structure of the panel must allow the correct flow of cooling air.

2.7 Electrical installation

⚠ Important:
when laying the wiring, "physically" separate the power part from the control part. The proximity of these two sets of wires will, in most cases, cause problems of induced disturbance or, over time, malfunctions or damage to the components. The ideal solution is to house these two circuits in two separate cabinets. Sometimes this is not possible, and therefore the power part and the control part must be installed in two separate areas inside the same panel. For the control signals, it is recommended to use shielded cables with twisted wires. If the control cables have to cross over the power cables, the intersections must be as near as possible to 90 degrees, always avoiding running the control cables parallel to the power cables.

Pay attention to the following warnings:
- use cable ends suitable for the corresponding terminals. Loosen each screw and insert the cable ends, then tighten the screws. When the operation is completed, slightly tug the cables to check they are sufficiently tight;
- separate as much as possible the sensor signal, digital input and serial line cables
- from cables to inductive loads and power cables, so as to avoid possible electromagnetic disturbance.. Never run power cables (including the electrical cables) and probe signal cables in the same conduits. Do not install the probe cables in the immediate vicinity of power devices (contactors, circuit breakers or similar);
- reduce the path of the probe cables as much as possible, and avoid spiral paths that enclose power devices;
- avoid touching or nearly touching the electronic components fitted on the boards to avoid electrostatic discharges (extremely damaging) from the operator to the components;
- do not secure the cables to the terminals by pressing the screwdriver with excessive force, to avoid damaging the controller: maximum tightening torque: 0.22-0.25 N•m.
- for applications subject to considerable vibrations (1.5 mm pk-pk 10/55 Hz), secure the cables connected to the controller around 3 cm from the connectors using cable ties.

2.8 Serial port connections

For serial connections (FBus and BMS ports), the cables used must be suitable for the RS485 standard (shielded twisted pair, see the specifications in the following table).

Main device	Serial port	Lmax (m)	Wire/wire capacitance (pF/m)	Resistance on first and last device	Max no. secondary devices on bus	Baud rate (bit/s)
MPXzero	FBus	500	<90	120 Ω	5	19200
MPXzero	VCC	500	<90	-	1	600
PC (supervision)	BMS	500	<90	120 Ω	-	19200

Tab. 2.b

The serial connection between the two controllers (FBus on Main and BMS on Secondary) must be made as shown in the following figures (+ to + and - to -).

Notice: connect a 120 Ω terminating resistor between the Tx/Rx+ and Tx/Rx- terminals on the last controller on the RS485 line. Do not connect GND to earth.

2.9 Functional diagrams

MPXzero can control stand-alone refrigeration units (plug-in with onboard compressor, either on-off or VCC) or multiple units (for example, one or more multiplexed showcases). These systems are made up of stand-alone controllers, or controllers that are connected to each other in a Main/Secondary arrangement in which each Main controller can manage up to five Secondary controllers. The following functional diagrams illustrate some typical applications.

2.9.1 Stand-alone configuration

Panel

MPXzero Standard and MPXzero Advanced

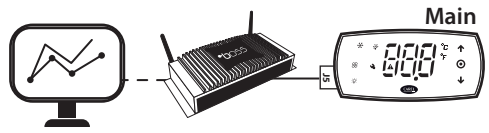


Fig. 2.m

MPXzero ADVANCED VCC Serial/Frequency

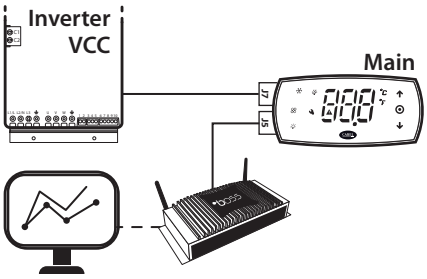


Fig. 2.n

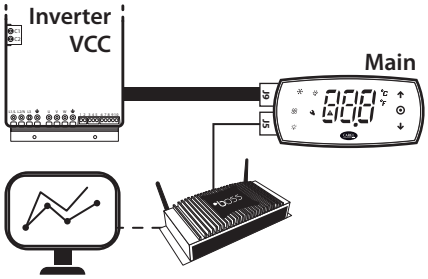


Fig. 2.o

Main/Secondary network for MPXzero Advanced M/S

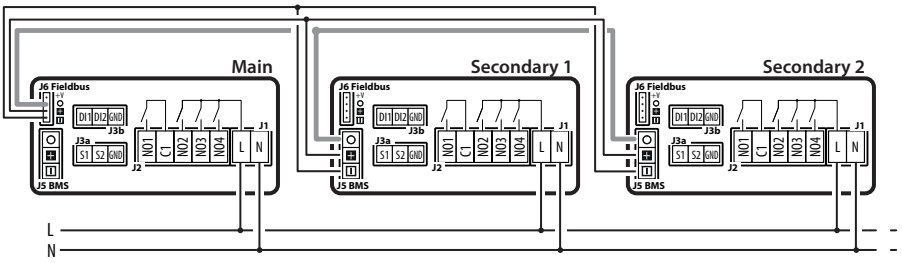


Fig. 2.p

RS485 supervisor network

Notice: if configuring a Main/Secondary local network, on the main controller, parameter H3 must be set based on the protocol used by the supervisory system (Modbus/Carel). On the Secondary devices, parameter H3 should always be left at the default value (1=Modbus).

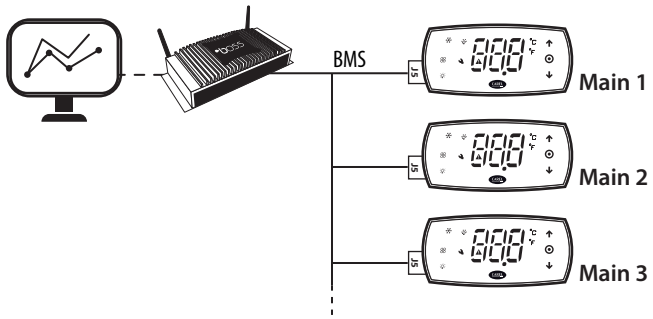


Fig. 2.q

2.10 Installation

For installation proceed as follows, with reference to the wiring diagrams:

- before performing any operations on the control board, disconnect the main power supply by turning the main switch in the electrical panel OFF;
- avoid touching the control board, as electrostatic discharges may damage the electronic components;
- the index of protection required for the application must be ensured by the manufacturer of the cabinet or by suitable assembly of the controller;
- connect any digital inputs, Lmax = 10 m;
- connect the actuators: the actuators should only be connected after having programmed the controller. Carefully evaluate the maximum ratings of the relay outputs as indicated in "Controller electrical and physical specifications";
- program the controller: see "User interface";
- for the connection of the Main/Secondary network and user interfaces, use shielded cable and check the maximum distances and cable sizes specified in "Electrical specifications";
- for safety devices (e.g. circuit breakers), comply with the following requirements:
  - IEC 60364-4-41;
  - standards in force in the country;
  - connection technical requirements of the power company.

⚠ **Important:** the following warnings must be observed when connecting the controllers:

- incorrect connection to 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 lightly tug the cables to check correct tightness;
- separate as much as possible the probe and digital input cables from cables to inductive loads and power cables, so as to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel cables) and probe signal cables in the same conduits;
- do not install the probe cables in the immediate vicinity of power devices (contactors, circuit breakers, etc.). Reduce the path of probe cables as much as possible, and avoid spiral paths that enclose power devices.

2.11 SPARK: configuration and commissioning software

SPARK is the configuration software, available for laptops, specifically designed to meet the needs of manufacturers and installers of multiplexed cabinets. The software is used to:

- configure access and password levels;
- change parameter sets and create custom read/write lists to upload to the device;
- add languages and parameter descriptions;
- view the trends of physical quantities in real time, with the possibility to save data in Excel format.

In order to carry out the operations mentioned above, a specific "workspace" (extension .spark) is required; this can be downloaded from ksa.carel.com.

Notice: the workspace is specific for each firmware version; the correct combination of file-controller firmware version is required for correct communication.

For the electrical connection, use the USB/RS485 converter CVSTDUMOR0.
Any authorisation, under license, is issued by CAREL.

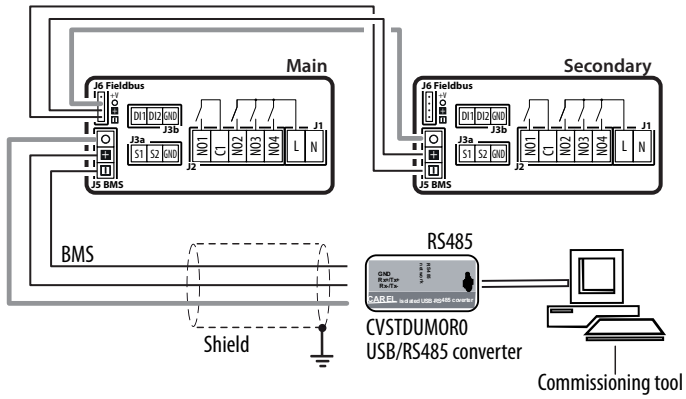


Fig. 2.r

2.12 SPARKLY: command line tool

SPARKLY is command-line software designed to be integrated into production systems, and is used to:
- load the parameter configuration onto the controller;
- update the device software;
- write specific information directly to the controller's s internal memory (serial number, production date, etc.);
- perform end-of-line tests (if properly integrated with a high-level system).

2.13 Setting the default parameters/loading the parameter sets

Two different sets of parameters can be saved in the MPXzero memory. These default sets can never be overwritten, being stored in a non-modifiable memory area. When resetting the system using the configuration wizard, one of the two configurations can be selected. Alternatively, a parameter set, differentiated by the user to control the specific refrigeration system, can be saved and uploaded to the linked cloud account using the Applica app, or using Sparkly directly on the production line.

Procedure for setting the default parameters/loading the parameter set

Set 0, called the working set, contains the set of parameters used by MPXzero during normal operation. This set is loaded whenever MPXzero is started, and the parameters can be modified at any time from the terminal, supervisor, APPLICA app and configuration software. The other two sets of parameters, numbered 1 and 2, contain other lists of parameters, preloaded by CAREL during production, which can be copied as desired to the working set (Set 0). These sets of parameters, unlike Set 0, can only be modified using the appropriate configuration software (SPARK). The sets of parameters (configured on the production line using SPARKLY), once differentiated by the manufacturer of the unit, can be loaded so as to rapidly set a list of parameters, with corresponding values, to control the refrigeration system.

User terminal

Procedure:
1. power down the controller;
2. power up the controller and when the software revision is shown (e.g. r1.3), press and hold PRG: at the end, the number 0 is displayed, which signifies the parameters have been reset to the default values;
3. to reset the parameters to the default values, press PRG and select 0, otherwise go to step 5;
4. press UP/DOWN to choose the set of parameters (1 or 2) to be loaded as the working set, and confirm by pressing PRG;
5. complete (if required) the commissioning procedure (see "Commissioning").

Applica

Procedure:
1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth, entering your profile credentials;
3. follow the path "Configurations/Configuration list";
4. select the "Default" or "Custom" label;
5. if required, confirm the configuration to be opened (if connected to the controller via NFC, select Upload at the top right and move the smartphone closer to MPXzero, while via Bluetooth the update will be completed automatically).

2.14 Applica: copy configuration

To simplify operations in the field, Applica includes a "Clone" feature to acquire the configuration from one unit and replicate it "one-for-one" to other cabinets.
Procedure:

1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth, entering the profile credentials;
3. follow the path "Configurations/Clone";
4. move the smartphone closer to the MPXzero to acquire the configuration from;
5. following the acknowledgement message, move the smartphone closer to the MPXzero to apply the same configuration to;
6. wait for the cloning confirmation message to be shown.

2.15 Applica: date/time and time bands

It is possible to set smartphone's date and time on the controller, via the drop-down menu on the side, selecting "settings-->device-->set date/time".

To set the day/night time bands:

Procedure:

1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth, entering your profile credentials;
3. open the "Scheduler" section;
4. define the day/night time bands for the different days of the week;
5. apply the set schedule to the controller (upload button at the top-right for connection via NFC).

Notice: up to 8 daily time bands can be configured by setting parameters tS1, tE1 to tS8, tE8.

3. USER INTERFACE

3.1 Introduction

The front panel of the user terminal includes the display and the keypad, featuring three buttons that, pressed alone or in combination, are used to program the controller. The user interface display features three digits with sign and decimal point, a buzzer for signalling alarms and eight icons. The terminal features wireless connectivity and an NFC (Near Field Communication) or Bluetooth interface for interaction with mobile devices (on which the CAREL "Applica" app has been installed, available on Google Play for the Android operating system and on Apple store for iOS devices, Bluetooth only).

Notice:

- the password for accessing the user terminal parameters is 33, and is different from the password for accessing the user levels (U=User, S=Service, M=Manufacturer) on the APPLICA app. See the parameter table.
- the unit of measure of the displayed values can be changed by setting parameter /5.

Important: the set of parameters accessible from the user interface is a subset of all the parameters available via the APPLICA app (mobile & desktop) and SPARK.

Code	Description	Def.	Min	Max	UoM	User	User terminal
/5	Unit of measure 0=°C/barg, 1=°F/psig	0	0	1	-	S	YES
PDM	Manufacturer password	44	-	-	-	M	NO
PDS	Service password	22	-	-	-	M	NO
PDU	User password	-	-	-	-	S	NO

Tab. 3.a

Notice: the user, service and manufacturer passwords can be changed directly by accessing the parameter list in the APPLICA app, and can contain up to 8 alphanumeric and special characters.

Notice: it is strongly recommended to change the default values of the passwords during commissioning. If the passwords are forgotten, contact CAREL support.

The buzzer and the keypad can be disabled by setting parameters H8 and H5 respectively.

Code	Description	Def.	Min	Max	UoM	User	User terminal
H5	Enable keypad and NFC functions 0=Disabled, 1=Enabled	1	0	1	-	U	NO
H8	Buzzer 0=No,1=Yes	1	0	1	-	U	NO

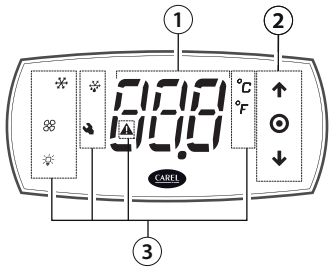
Tab. 3.b

The information available on the user terminal and in the Applica app may vary according to the type of profile, the password entered and the configuration parameters set by the manufacturer. See the parameter table.

3.2 User terminal

The display shows measurements in the range between –50°C and +150°C (or in °F if set using parameter /5), according to the type of probe used. The decimal point can be disabled by setting a parameter (/6).

User terminal



Key:

1	Main field
2	Keypad
3	Operating mode

Fig. 3.a

Notice:

- the user terminal can only be used to set the frequent parameters and display the value of the probes connected to MPXzero. The Service- and Manufacturer-level parameters are set using the "Applica" app or the configuration software, depending on the access profile. See the parameter table and the paragraph "Parameter categories visible on the user terminal";
- Parameter /t1 is used to choose the variable to be shown on the display during normal operation:

Code	Description	Def.	Min	Max	UoM	User	User terminal
/6	Display decimal point 0=Yes, 1=No	0	0	1	-	S	NO
/t1	Display on user terminal 0 = Terminal disabled 1,2,3 = Probe 1,2,3 4, 8 = Reserved 9 = Control probe 10 = Virtual probe 11 to 14 = Serial probe 1 to 4 15 = Temperature set point	9	0	15	-	S	NO

Tab. 3.c

3.2.1 Keypad

Button	Description	Function
↑ ↓	UP / DOWN	• Increase/decrease the value • Scroll direct access functions • LED on: scroll menu, parameters, direct access functions • LED flashing: set parameter values
⊙	PRG	Pressed briefly: • Save value and return to the parameter code • Mute buzzer Pressed and held (hold until "---" is shown): • Enter direct access function menu (from main screen) and activate/deactivate functions Pressed and held (hold after "---" is shown): • Enter programming mode or return to previous level without saving • LED on: main screen/programming mode

Tab. 3.d

Notice: when scrolling, a button is enabled only when illuminated.

3.2.2 Display

The icons provide information on device operation and/or the activation of certain functions, as shown in the table.

Icon	Function	On	Flashing
❄	Solenoid/compressor	Solenoid/compressor active	Compressor timers active
✿	Evaporator fan	Evaporator fan on	-
💡	Lights	Light on	-
❄	Defrost	Defrost active	Awaiting defrost
🔧	Service	Maintenance request	
⚠	Alarm	Alarm acknowledged	Alarm active
°C	Unit of measure degrees Celsius	Unit of measure °C	-
°F	Unit of measurement degrees Fahreinheit	Unit of measure °F	-

Tab. 3.e

3.2.3 Standard display

At start-up, the user terminal briefly shows "NFC", indicating that the NFC interface is available for communication with mobile devices, then the Firmware version, and then the standard display is shown. The standard display depends on the setting of parameter /t1:

- control temperature (control probe temperature or calculated based on two probes, see "Functions");
- value of one of the probes connected to the analogue inputs;
- control/virtual probe;
- temperature set point.

Notice: the message "bLE" flashes during the Bluetooth connection on the user terminal.

3.2.4 Programming mode

The user terminal only provides access to the Basic configuration parameters, such as direct functions and active alarms without password protection, or, with password protection, unit set-up (*). Press PRG, the display will show "Loc" (display locked), on the main screen, hold PRG for 3s until the display is unlocked "---", enter the password 33 to access programming mode; see the menu description for details of the items available.

Notice: (*) for any optimisations, use the APPLICA app.

Parameter categories visible on the MPXzero Standard and Advanced user terminal

VIS (Display)	Direct commands	CtL (Control) / Analogue inputs	DEF (Defrost)	ALM→Thr (Alarms)	FAN (Fan)	CNF Connectivity/ Fieldbus/ Control/Display	RTC
Sm **	Lht	On	d0	AA	F0	H0	y_
Sd **	Cnt	St	dI	A0	F1	H2	M_
Sr	dEF	rd	dt1	AL	F2	H1	d_
Sa	dFn	/P1	dP1	AH	F3	H3	h_
SU	CLn	/FA		Ad	ESC	In *	m_
Svt	On/Off	/Fb	ESC	rES		Sn *	d_
Vsr **	ESC	/Fc		HMr		r7 *	u_
ESC		ESC		ESC		/5	ESC
						ESC	

Tab. 3.f

* = Advanced only
** = parameters displayed (VIS) for MPXzero VCC.

Notice:** parameters not available on the Standard version.

Parameter categories visible on the user terminal, MPXzero VCC model

VIS (Display)	Direct commands	CtL (Control) / Analogue inputs	DEF (Defrost)	ALM→Thr (Alarms)	FAN (Fan)	CNF Connectivity/ Fieldbus/ Control/Display	RTC	Vdc (Variable Compressor)
Sm	Lht	On	d0	AA	F0	H0	y_	/P5 **
Sd	Cnt	St	dI	A0	F1	H2	M_	/P6 **
Sr	dEF	rd	dt1	AL	F2	H1	d_	CMi
Sa	dFn	/P1	dP1	AH	F3	H3	h_	CMA
SU	CLn	/FA		Ad	Ac	/5	m_	Cnf
Svt	On/Off	/Fb	ESC	rES	AE	ESC	d_	CMf
vSr	ESC	/Fc		HMr	Acd		u_	Csc
ESC		ESC		ESC	F00		ESC	Cdf
					F4			cct
					ESC			ESC

Tab. 3.g

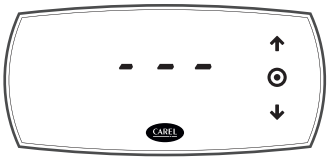
** Available only on the VCC Frequency version

Procedure

To navigate the menu tree, use the following buttons:
- UP and DOWN to navigate the menu and set the values;
- PRG to enter the menu items and save the changes made;
- PRG (3s) to select the menu item or ESC to return to the previous branch. Example of how to set parameter St (set point):

1. Wait for the standard display to be shown;

2. Press PRG, the display will show "Loc" (display locked)



3. Press and hold PRG and until "PSd" is shown

4. When PSd is shown, press PRG and use the UP arrow to enter the password: 33

5. Press PRG: the first category of parameters is displayed: VIS (=Display)

6. Press DOWN: the second category of parameters is displayed: CtL (=Control)

7. Press DOWN until reaching parameter St (=set point) and PRG to display the value

8. Press UP/DOWN to modify the value

9. Press PRG to save the setting and return to the parameter code

10. Press PRG for 3 sec or alternatively, in the parameter level select ESC and press PRG to return to the parameter categories

11. Press DOWN to move to the next category dEF (=Defrost) and follow steps 5 to 9 to set the other parameters

12. After having completed the settings, to exit either: a) from the categories press ESC and then PRG; or b) press PRG for 3 s

Notice: if no button is pressed, after around 1 minute the terminal will automatically return to the standard display.

Mobile device and PC

The "APPLICA" app and SPARK software can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication) or Bluetooth. The controller can be programmed according to the profile used for access to APPLICA or SPARK, with different parameter visibility depending on the rights associated with each profile (User, Service, Manufacturer). Procedure:

1. download the"Applica" app;
2. (on the mobile device) start the app for commissioning the controller;
3. activate NFC;
4. move the device closer to the controller, less than 10 mm away;
5. follow the instructions shown on the display.

3.2.5 Direct functions

The following functions can be activated directly from the keypad or via the app:

Icon	Display	On/Off
	Lht	Cabinet light
+	Cnt	Continuous cycle
	dEF	Defrost
	dFn	Network defrost (Main only)
	CLn	Clean cabinet
	ON	Unit ON with control request

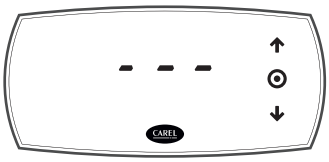
Tab. 3.h

Procedure:

1. go to the standard display;
2. press PRG until "---" is shown and then release immediately to unlock the display
3. press PRG again to access the direct commands (the first item will be the light command Lht);
4. press PRG to turn the light on/off and DOWN to move to the next direct function;
5. follow the previous steps for all the other functions;
6. When finished, press Esc to exit.

1. Go to the standard display;

2. Press PRG until "---" is displayed and then release immediately.



3. Press PRG again: Lht is displayed, the UP and DOWN buttons light up. Press PRG to turn the light on/off: the icon will come on or go off. Press DOWN to activate the next function (Cnt) or press Esc to exit

4. Select Esc to exit

5. The standard display is shown

4. COMMISSIONING

Once the electrical connections have been completed (see "Installation") and the power supply has been connected, the operations required for commissioning the controller depend on the type of interface used, however essentially involve setting the so-called initial configuration parameters.
The initial configuration procedure can be run on the user terminal or mobile device (with the APPLICA app).
The parameters used for commissioning are shown in the Parameter table.

⚠ **Important:** the parameters that can be set on the user terminal and in the APPLICA app may vary according to the rights assigned to the access profile, defined by the manufacturer. Therefore, not all of the following parameters may be visible or modifiable.

4.1 Wizard

MPXzero features highly configurable inputs and outputs. CAREL in any case recommends a configuration following the default settings of the parameters. By following this suggestion, the controller can independently manage the main functions in most applications, without having to significantly modify the settings of the parameters.

4.1.1 User terminal

When first started, MPXzero runs a procedure (configuration wizard) that requires the settings of the critical parameters, relating to:
- correct configuration of the probe types;
- correct communication between controller and supervisor;
- correct configuration of the VCC compressor or Main/Secondary network parameters.

Notice: the configuration wizard can also be:
- run via the "APPLICA" app
- skipped by creating a parameter configuration using the SPARK configuration software.

During this procedure, the device remains in standby and all of its functions are deactivated (including control and communication via RS485). Only after having set all of the required parameters will it be possible to continue with normal configuration.

Notice: at the end of the guided procedure (wizard), the controller uses the default parameters (for example, set point at the default value 50°C, and therefore there will be no request).

4.2 APPLICA app

The "APPLICA" app can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication, Android devices only) or Bluetooth.
Procedure (modify parameters):
- download the CAREL "Applica" App, available on the Google Play Store and Apple Store;
- (on the mobile device) enable NFC and/or Bluetooth(*) communication and mobile data;
- open Applica;
- if using NFC communication, move the device to a distance of less than 10 mm from the user terminal, so as to recognise the model and firmware;
- select the access profile and enter the required password (**);
- set the parameters as needed;
- move the mobile device near to the user terminal again to upload the configuration parameters.

(*) some Android devices may require geolocation to be enabled in order to view the list of Bluetooth devices in the area.

(*) pre-assigned by the unit manufacturer to allow maintenance only by authorised service technicians. See the parameter table.

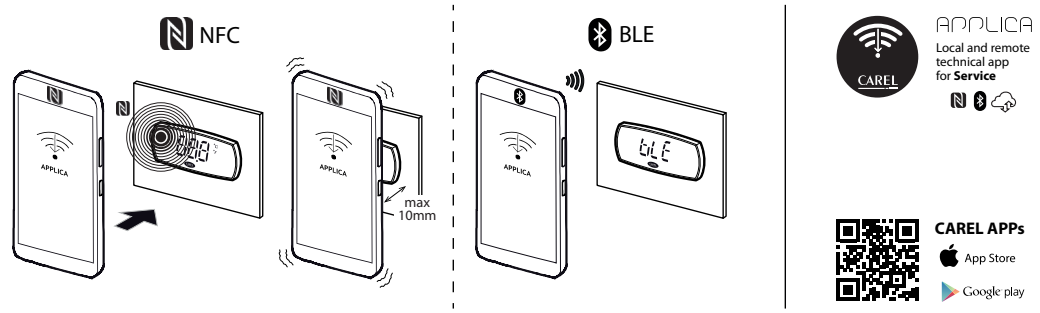


Fig. 4.a

4.2.2 Applica Desktop

Applica Desktop is configuration software for laptops that provides the following functions via an RS485 serial connection:
- configure the controller;
- change parameter sets and create custom lists to upload to the device;
- view the trends of physical quantities in real time, with the possibility to save data in Excel format.

For the electrical connection, see "Spark: configuration and commissioning software"

Commissioning parameters

Par.	Desc.	Visibility
In	Type of unit	MPXzero Advanced M/S
Sn	Number of Secondary units in the local network (*)	MPXzero Advanced M/S
H0	Serial or Main/Secondary network address	MPXzero Standard, Advanced M/S, Advanced VCC
H3	BMS serial port protocol	MPXzero Standard, Advanced M/S, Advanced VCC
/P1	Type of probe, group 1 (S1, S2, S3)	MPXzero Standard, Advanced M/S, Advanced VCC
Cnf	Minimum compressor control frequency	MPXzero Advanced VCC
CMf	Maximum compressor control frequency	MPXzero Advanced VCC
cSc	Compressor activation frequency	MPXzero Advanced VCC
End	Exit the initial configuration procedure	

Tab. 4.a

(*) not displayed if In = 0;

⚠ **Important:** at the end of the configuration wizard, the unit will be ON and the temperature set point = 50°C.

4.3 Description of the initial configuration parameters

In: Type of unit

Parameter In assigns the function, Main or Secondary, to the controller.

Code	Description	Def	Min	Max	UOM	User	User terminal
In	Type of unit 0=Secondary, 1=Main	0	0	1	-	S	YES

Sn: Number of Secondary devices in the local network

This parameter tells the Main controller how many Secondary controllers it needs to manage in the local network. If Sn = 0, this is a stand-alone unit. The maximum number of Secondary controllers in a subnet is 5. On Secondary controllers, the parameter must be left at 0.

Code	Description	Def	Min	Max	UOM	User	User terminal
Sn	Number of Secondary devices in the local network 0 = no Secondary device	0	0	5	-	S	YES

H0: Serial or Main/Secondary network address

On a Main controller, this represents the address of the controller in the CAREL or Modbus supervisor network.
On the Secondary devices, only the address H0 needs to be set, as follows:
In = 0
Sn = 0
H3 = 1

The address of Secondary controllers must comply with the following rule (see the example):

$$H0_{slave} = H0_{master} + n$$

$$n = 1 \ldots 5$$

Notice: On the Main controller, to avoid slower network management, Sn must exactly coincide with the number of Secondary devices physically connected and with the address correctly set in the Main/Secondary network.

Code	Description	Def	Min	Max	UOM	User	User terminal
H0	Serial or Main/Secondary network address	199	1	247	-	S	YES

Important: if multiple Main controllers, with their own local networks, are connected to a supervisor network, the address set for each Main controller must consider the number of Secondary devices in the previous network.

Important: when using CAREL protocol (H3=0), the maximum limit of parameter H0 is 207.

Notice: only the Main controller needs to be connected to the RS485 serial line (BMS connector), all of the Secondary controllers communicate with the supervisor via the Main, connected to the Main's RS485 Fieldbus port (FBus connector). See "Functional diagrams".

Example

The addresses must be configured for a supervisor network comprising three Main controllers, which respectively manage 5, 3 and 1 Secondary controllers.

Solution

For example, assign to the three Main controllers the addresses H0 = 100, 110, 120 respectively, which also represent the controller address in the supervisor network. See the figure below for the addresses to be assigned to the Secondary controllers.

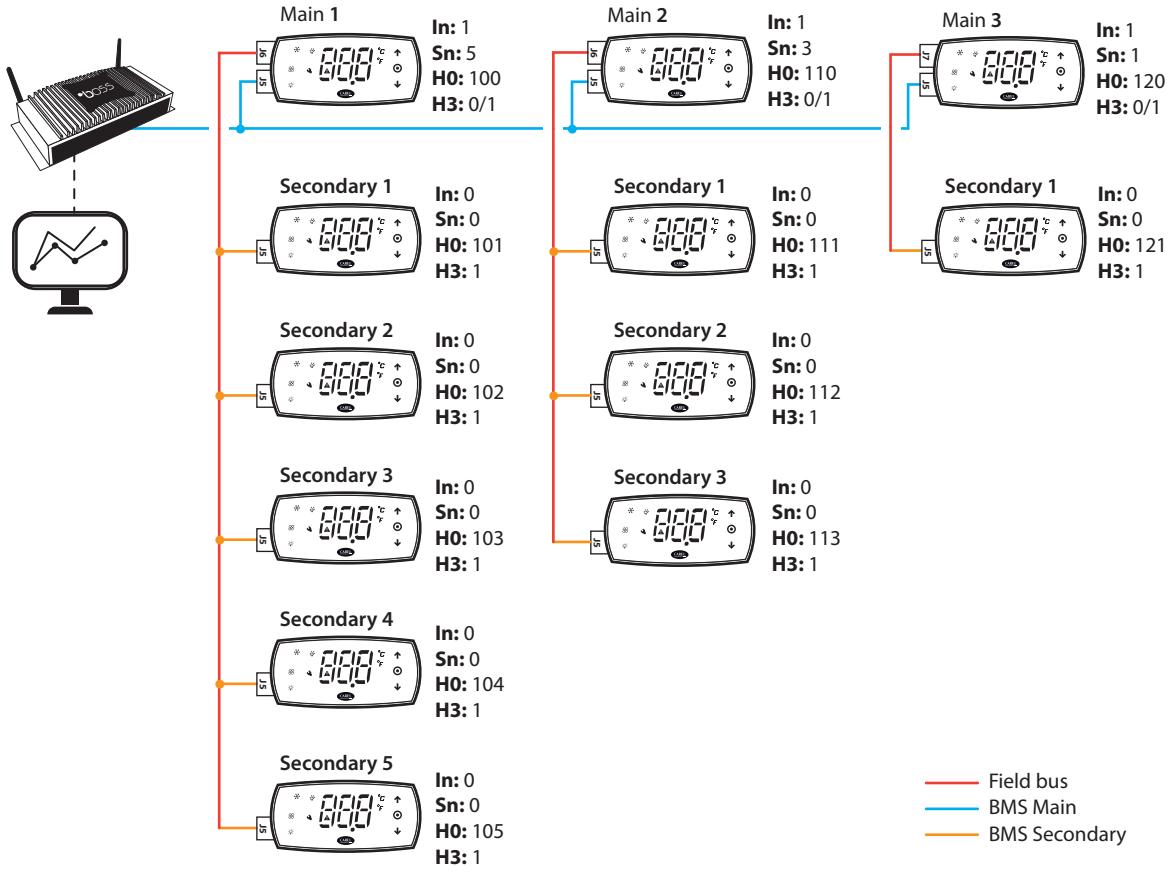


Fig. 4.b

Notice: MPXzero is compatible with Carel and Modbus® supervisor networks. The type of protocol is set via parameter H3, only on Main controllers.

H3: BMS serial protocol

MPXzero is compatible with Carel and Modbus supervisor networks, which can be selected using parameter H3.

Notice: on the Main controller, parameter H3 must be set based on the protocol used by the supervisory system (Modbus/ Carel). On the secondary devices, parameter H3 must always be left at the default value (1=Modbus).

Code	Description	Def	Min	Max	UOM	User	User terminal
H3	BMS serial port protocol 0 = CAREL, 1 = Modbus	1	0	1	-	S	YES

/P1: Type of probe, group 1 (S1, S2, S3)

This is used to select the type of temperature probe to be used for inputs S1, S2 and S3.

Code	Description	Def	Min	Max	UOM	User	User terminal
/P1	Type of probe, group 1 (S1, S2, S3) 0 = PT1000 Standard Range –50T150 °C 1 = NTC Standard Range –50T90°C	1	0	1	-	S	YES

Cnf: Minimum compressor control frequency

This is used to define the minimum frequency fro driving the VCC compressor.

Code	Description	Def	Min	Max	UOM	User	User terminal
Cnf	Minimum compressor control frequency	52	0	255	-	S	YES

CMf: Maximum compressor control frequency

This is used to define the maximum frequency for driving the VCC compressor.

Code	Description	Def	Min	Max	UOM	User	User terminal
CMf	Maximum compressor control frequency	100	0	255	-	S	YES

cSc: Compressor activation frequency

This is used to define the frequency required to start the VCC compressor.

Code	Description	Def	Min	Max	UOM	User	User terminal
cSc	Compressor activation frequency	53	0	255	-	S	YES

4.4 Checks after commissioning

Once having completed the installation, configuration and programming operations, after commissioning the controller check that:

- the programming logic is suitable to control the unit and the system in question;
- the time has been set on the controller;
- the day/night time bands have been set correctly;
- the standard display has been set on the user terminal;
- the appropriate unit of measure has been set for the temperature probes (°C or °F);
- the passwords have been changed to avoid unwanted parameter settings;
- the label on each controller shows:
  - serial address;
  - whether Main or Secondary;
  - the number of Secondary devices featured on the Fieldbus line;
  - any notes.

Important: at the end of the commissioning procedure, the alarm log can be reset via the APPLICA app. See "Alarms".

5. FUNCTIONS

If the settings made during commissioning are not sufficient to achieve the desired operation, further (detailed) configuration of the parameters can be performed, as described in the following paragraphs.
The parameters described below can be configured via the configuration software or the "APPLICA" app.

⚠ **Important:** the information available in Applica may vary according to the password set and the configuration defined by the unit manufacturer, and consequently not all of the parameters shown may be visible or modifiable.
For details on the parameters and the related access levels, see the "Parameter table".

5.1 Inputs and outputs

MPXzero features up to 2 analogue inputs, 1 multifunction input (analogue/digital) and 1 digital input. See the description of the terminals in "Description of the terminals".
The probes (NTC, PT1000 temperature) that can be connected to the analogue inputs are divided into a single group, and is therefore the same for all probes. See the parameter table.

Model	P/N	Passive probes		Digital outputs	Fielbus / VCC serial	Outputs (Y1, Y2)	
		NTC (–50T90 °C)	Pt1000 (–50T150 °C)			PWM	0 to 10 Vdc
STANDARD	S0MPSS3R02S0333	YES	YES	3	NO	NO	NO
ADVANCED	S0MPSA4R03SA000	YES	YES	4	Fieldbus	NO	NO
	S0MPSA4B03S0274	YES	YES	4	Fieldbus	NO	NO
	S0MPSA4R06S0319	YES	YES	4	NO	YES	YES
	S0MPSA4B04S0320	YES	YES	4	VCC serial	NO	NO

Tab. 5.a

⚠ **Important:** observe the maximum allowable current limits on the relays. See the technical specifications table.

5.1.1 Probes (analogue inputs)

MPXzero version	Standard			Advanced		
Analogue input	S1	S2	S3	S1	S2	ID1
Parameter for type of probe	/P1			/P1		
0 = PT1000 Standard (range –50T150 °C)	●	●	●	●	●	●
1 = NTC Standard (range –50T90 °C)	●	●	●	●	●	●

Tab. 5.b

To assign the function to each physical or serial probe, configure parameters /FA, /Fb, ... /Fn. See the parameter table.

Probe	Par.
Outlet (Sm)	/FA
Defrost (Sd)	/Fb
Intake (Sr)	/Fc
Defrost probe 2 (Sd2)	/FF
Dewpoint	/Fn
Auxiliary temperature 1 (Saux 1)	/FG

Probe	Par.
Auxiliary temperature 2 (Saux 2)	/FH
Ambient temperature	/FI
Glass temperature	/FM
Ambient humidity (SU)	/FL
Condenser temperature	/Fo *

Tab. 5.c

*MPXzero VCC version only

Assign probe functions (parameters /FA, /Fb, /Fc)

Code	Description	Def	Min	Max	UOM	User	User terminal
/FA	Assign outlet temperature probe (Sm)	1	-4	3	-	S	YES

Val.	Desc.	Val.	Desc.
0	Function disabled	-1	Serial probe S11
1	Probe S1	-2	Serial probe S12
2	Probe S2	-3	Serial probe S13
3	Probe S3	-4	Serial probe S14

/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	3	-	S	YES
/Fc	Assign intake temperature probe (Sr) - see /FA	3	-4	3	-	S	YES

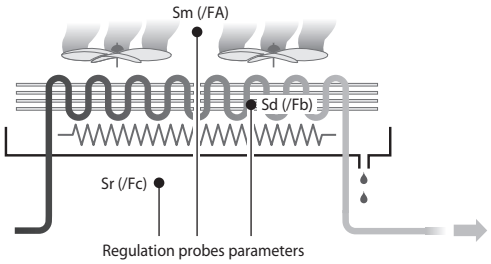


Fig. 5.a

MPXzero, inside the showcase or cold room, can use temperature probes to measure:
- the air outlet temperature (at the evaporator outlet);
- the defrost temperature (in contact with the coldest point of the evaporator);
- the air intake temperature (at the evaporator inlet).

The default configuration for assigning the control probes is as follows:
- S1 = Outlet probe (Sm);
- S2 = Defrost probe (Sd);
- S3 = Intake probe (Sr).

The default configuration also involves these three probes being standard CAREL NTC. However, other PT1000 probes can be connected by setting parameter /P1. On MPXzero the default settings can be changed to choose the function associated with any of the probes connected. There are also cases where the characteristics of the applications require different settings.

Share control status - multi-evaporator applications

This function is used to satisfy the needs of cold rooms or showcases with multiple evaporators, where the Secondary devices are essentially used as expansions for the management of different evaporators. This function shares the Main control status across the LAN (RS485). In this way, the Main determines the control status, and each Secondary operates as a consequence, ignoring the parameters set locally. Consequently, the Secondary controllers can be used without the air outlet and intake probes. If the Secondary controller is not accessible from the Main, duty setting operating mode must be activated, setting the corresponding parameter c4 >0.

Activation: to activate sharing of the control status, set /FA = 0 and /Fc = 0 on the MPXzero Secondary controllers.

Notice:
- the configuration /FA = 0 and /Fc = 0 on a Main controller causes the alarm 'rE' (control probe alarm)
- if the Secondary controller is not accessible from the Main, alarm 'MA' is displayed (Communication error with the Main - only on the Secondary)

The function manages the control status (activation and deactivation of the cooling request) on the Secondary controllers from the Main via the LAN (RS485). This means that only the Main parameters (set point, differential, night-time set point variation, control offset in the event of probe error) affect the control algorithm. The value of the same parameters on the Secondary devices has absolutely no influence. If the Secondary controller is not accessible from the Main (the user interface shows alarm 'MA'), "duty setting" mode is activated based on the local setting of parameter c4, and the corresponding management (duty setting starts with compressor on if this was on, and with compressor off if it was off).

Notice:
- if the Main controller enters duty setting mode, the related Secondary controllers follow as regards the compressor management times and the user interface does not show the icon flashing when the compressor is off, due to the fact that they ignore the Main control mode. On the other hand, if the Secondary controllers enter duty setting mode due to lack of communication with the Main; in this case they manage the user interface correctly;
- activation of continuous cycle on the Main means all the dependent Secondary devices observe the compressor management times set on the Main (parameter cc on the Main only will take effect, while the settings on the Secondary devices will be ignored). This operating mode is only highlighted on the Main user terminal, as the Secondary controllers ignore the Main control mode. This means that a Secondary controller serving the Main, even in the continuous cycle, manages the user interface as if it were in normal control (solenoid/compressor icon on during cooling request and off when no request). Attempts to activate continuous cycle on a Secondary serving the Main are ignored, both local and sent from the Main.

Calibration (parameters /cA to /co)

MPXzero allows the possibility to calibrate values read by the probes associated with the various functions set by parameters /FA to /Fn and some internal variables. In particular, parameters /cA, .../cn, /cc are used to increase or decrease the values read by the probes connected to the analogue inputs across the range of measurement.

Important, HACCP: this modification may not be allowed by HACCP procedures as it alters the measured value. Verify that you have authorisation and record the changes where required.

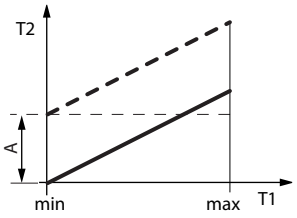


Fig. 5.b

Ref.	Description
T1	Outlet temperature read by the probe
T2	Outlet temperature (value corrected by T1 with offset A)
A	Offset (parameter /ca for outlet probe)
min, max	Field of measurement

Tab. 5.d

Code	Description	Def	Min	Max	UOM	User	User terminal
/cA	Outlet temperature probe (Sm) calibration	0	-20	20	°C/°F	S	NO
/cb	Defrost temperature probe (Sd) calibration	0	-20	20	°C/°F	S	NO
/cc	Intake temperature probe (Sr) calibration	0	-20	20	°C/°F	S	NO

HACCP, caution: modifying the parameters that influence temperature measurement and display may not be allowed in certain applications (e.g.: HACCP).

Notice: To calibrate the other probes, see the parameter table in chapter 6.

/2: Analogue probe measurement stability

Code	Description	Def	Min	Max	UOM	User	User terminal
/2	Analogue probe measurement stability	9	1	15	-	M	NO

Defines the coefficient used to stabilise the temperature measurement. Low values assigned to this parameter allow a prompt response of the sensor to 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, precise and filtered reading.

5.1.2 Digital inputs

MPXzero manages 1 physical digital input, an additional multifunction digital input and 1 virtual digital input. See "Installation". To associate a physical or virtual input to each available function, set parameters DIA, DIb, ... DIr to the value relating to the physical or virtual digital input. See the parameter table.

Digital input functions

Digital input assignment for:	Par.	Contact	
		Open	Closed
immediate external alarm	DIA	Active	Not active
delayed external alarm	DIb	Active	Not active
enable defrost	DIc	Not enabled	Enabled
start defrost	DId	Not active	Active
door switch with stopping control	DIE	Door open	Door closed
remote ON/OFF	DIF	OFF	ON
curtain switch/light	DIG	Day status	Night status
start/stop continuous cycle	DIH	Not active	Active
digital input monitoring	DIl	Active	Not active
timed digital input	DIL	Active	Not active
switch to standby status	DIM	Active	Not active
switch to clean status	DIn	Active	Not active
change working set	DIo	Set 1	Set 2
door switch without stopping control	DIp	Door open	Door closed
defrost corresponding to digital input status	DIr	Not active	Active
digital input for generic alarm function	DIS	Not active	Active
low suction pressure alarm (MPXzero VCC only)	DIZ	Not active	Active

Tab. 5.e

Parameters rIA, rIb,..., rIs can be used to reverse the logic of the functions associated with the digital inputs.

Code	Description	Def	Min	Max	UOM
rIA, rIb, ...,rIz	Reverse digital input logic	0	0	1	-

Notice: reversing the logic has no effect on the virtual DI. It is not recommended to reverse the digital input logic when this also needs to be used as a virtual input (e.g. broadcast to the Secondary controllers). In fact, the opposite effect would be obtained on the Secondary controllers.

The virtual digital input is a function by which the status of a digital input is broadcast via LAN (RS485) from Main to Secondary. This is useful, for example, when using a switch to change from day to night status and vice-versa without extra wiring from the Main to the Secondary devices. The virtual digital input can be set by the supervisor or by the Main, according to the setting of parameter A9 (set only on the Main).

Code	Description	Def	Min	Max	UOM	User	User terminal
A9	Select digital input broadcast from Main to Secondary devices (only on Main)	1	-1	2	-	S	NO

Val.	Desc.	Val.	Desc.
-1	from the supervisor	1	digital input 1 (ID1)
0	disabled	2	digital input 1 (ID2)

Setting parameters DIA, DIb, ... DIr to -1 allows the virtual digital input to be selected on the Secondary as an input. If needed, different functions can be configured on the Secondary devices, meaning when the status of the contact on the Main changes, different functions are activated on the Secondary devices.

Code	Description	Def	Min	Max	UOM
DIA, DIb, ... DIr	Assign digital input function - 1: serial digital input	0	-1	2	-

Immediate external alarm (par. DIA)

Activation of the alarm causes:

- message 'IA' shown on the display and ALARM flashing;
- activation of the buzzer (see par. H8);
- activation of the alarm relay (see par. DOb);
- deactivation of the solenoid/compressor output (see par. A10).

Notice: activation of the external alarm shuts down the evaporator fans only if these follow the status of the compressor output, as set for parameter F2. When the compressor is shut down due to an external alarm the compressor minimum ON time is ignored (parameter c3).

Code	Description	Def	Min	Max	UOM	User	User terminal
DIA	Select digital input broadcast from Main to Secondary devices (only on Main)	1	-1	2	-	S	NO

Val.	Desc.	Val.	Desc.
-1	from the supervisor	1	digital input 1 (ID1)
0	disabled	2	digital input 1 (ID2)

Delayed external alarm (par. DIb)

The behaviour of this alarm is the same as for the immediate external alarm, with a delay in activation (parameter A11). If set to 0, the alarm is signal-only.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIb	Assign delayed external alarm digital input - see DIA	0	-1	2	-	S	NO

Enable defrost (par. DIc)

This is used to disable any defrost calls. When the contact is open, all defrost calls are ignored. Par. d5 can be used to delay activation.

Notice:

- if the contact is open while a defrost is in progress, this is immediately stopped, the defrost icon flashes on the display indicating the defrost call is active (this starts again when the contact closes);
- this function can be useful to prevent defrosting the units at unwanted times.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIc	Assign enable defrost digital input - see DIA	0	-1	2	-	S	NO

Start defrost (par. DId)

Closing the digital contact starts a defrost, if enabled. With a Main-Secondary network connection, if the controller is the Main, the defrost will be a network defrost, while if it is a Secondary, it will only be a local defrost. The defrost digital input can be used effectively to perform real time defrosts. Simply connect a timer to the multifunction digital input on the Main and use d5 to delay the defrosts on the various Secondary devices and thus avoid current overloads.

Notice: if the defrost is disabled by another digital input configured as "enable defrost", the defrost calls are ignored. The defrost does not end when the contact opens again, but rather follows the set defrost times and configurations.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIb	Assign delayed external alarm digital input - see DIA	0	-1	2	-	S	NO
d5	Defrost delay at power-on or (for Secondary) after control signal from Main 0 = delay disabled	0	0	240	min	S	NO

Door switch with stop control (par. DIE)

Door open:

- stop control (solenoid/compressor and evaporator fans off); alternatively, control can be kept active by setting parameter DIP (see the description below);
- light on (see par. DOE);
- ALARM flashing;
- disable temperature alarms.

Door closed:

- resume control;
- light off (see par. DOE) with delay set by par. H14;
- ALARM stops flashing;
- enable temperature alarms with delay Ad after bypass time defined by par. Add

Code	Description	Def	Min	Max	UOM	User	User terminal
DIE	Assign digital input for door switch with solenoid/compressor and evaporator fans OFF - see DIA	0	-1	2	-	S	NO
DOE	Assign light digital output - see DOA	4	0	4	-	S	NO
H14	Time light stays on after closing the door	0	0	240	min	U	NO
Ad	Delay time for high and low temperature alarms (AH, AHA, AL, ALA)	120	0	240	min	U	YES
Add	High temperature alarm bypass time for door open	30	1	240	min	U	NO
Tdoor	Door open: alarm delay	30	1	240	min	S	NO

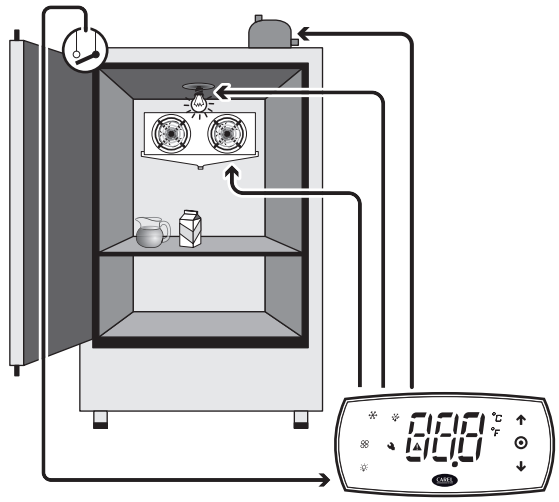


Fig. 5.c

Important: check compatibility of disabling/delaying the alarm with the site's HACCP procedures.

Notice:

- when control resumes, the compressor times are observed (see the paragraph "Compressor");
- if the door remains open for longer than the value of par. Tdoor, control resumes in any case. The light remains on, the measurement shown on the display flashes, the buzzer and the alarm relay are activated, and the temperature alarms are enabled with delay Ad+Add.

Remote ON/OFF (par. DIF)

When the controller is OFF:

- the user terminal shows the value measured by the set probe (parameter /t1) alternating with the message OFF;
- the auxiliary relays set as AUX and light remain active, while the other auxiliary outputs are deactivated;
- the buzzer and alarm relay are deactivated;
- the following are not performed: control, defrosts, continuous cycle, temperature alarm signals;
- the compressor protection times are observed.

When the controller is ON again, all the functions are reactivated, except for the defrost on start-up and compressor and evaporator fan delay at power on (par. c0).

Notice:

- the OFF command from digital input has priority over those from the keypad or supervisor;
- if the controller remains OFF for a longer time than the value set for parameter dI, a defrost is performed when the controller is switched on again.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIF	Assign remote ON/OFF digital input - see DIA	0	-1	2	-	S	NO
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	YES
c0	Delay to enable solenoid/compressor and evaporator fans at power on	0	0	240	min	M	NO

Curtain switch (par. DIG)

During night status:

- the night-time set point Stn is used for control, calculated based on the set point St plus the offset defined by parameter r4 (Stn = St + r4). The control probe can also be modified according to the setting of parameter r6 (0 = virtual probe, 1 = probe), see the paragraph "Control";
- the AUX or light output is deactivated according to the setting of parameter H9.

During day status:

- normal operation resumes: set point = St, virtual probe used as control probe;
- AUX or light output activated according to the setting of parameter H9.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIG	Assign curtain switch digital input - see DIA	0	-1	2	-	S	NO
H9	Output switched with time bands 0 = Light 1 = AUX	0	0	1	-	S	NO
r4	Automatic night set point variation	0	-50	50	°C/°F	S	NO
r6	Probe for night-time control 0/1 = virtual probe Sv/air on probe Sr	0	0	1	-	S	NO

Start/stop continuous cycle (par. DIH)

When the contact is closed, the continuous cycle is activated, based on parameters cc and c6 (see "Functions"). When the contact opens again, the continuous cycle is deactivated.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIH	Assign start/stop continuous cycle digital input - see DIA	0	-1	2	-	S	NO

Timed input (timer) (par. DIL)

The timed digital input is a special configuration that allows, in the transition from not active to active, the activation status of a specific digital variable to be maintained on the supervisor for a time set by parameter. To enable the function, select the desired digital input using parameter DIL.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIL	Assign timed digital input - see DIA	0	-1	2	-	S	NO

When a digital input is configured as a timed digital input and a transition occurs from not active to active, supervisor variable FOo is set to ON and remains ON regardless of the physical status of digital input for the time set by parameter dIt. Setting parameter dIt to 0 disables the function. The "Timer" variable can be associated with an AUX digital output (relay) by suitably setting the related parameter DOo, thus aligning it with the status of the "Timer" variable. The timed digital input can be controlled not only by a physical digital input but also from the supervisor using the related digital control variable, with the same result. The same function can be used to set the "Timer" variable OFF regardless of whether or not the time set for parameter dIt has elapsed.
Special features:

- when the "Timer" variable is ON, another transition from OFF to ON of the same digital input resets the timeout;
- as it is possible to configure an output as a replica of the "Timer" variable, following a transition of the variable, all of the outputs will switch simultaneously.

Code	Description	Def	Min	Max	UOM	User	User terminal
dIt	Timer duration (timed input) 0 = function disabled	0	0	999	min	S	NO
DOo	Assign timed digital output - see DOA	0	0	4	-	M	NO

Switch to standby status (par. DIM)

Standby status is an intermediate state between ON and OFF: control is interrupted, the expansion valve is closed (0%), the control alarms and probe alarms remain active. ON status (normal operation) resumes after the time Stt has elapsed, after switching off (OFF status) or when the controller is restarted.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIM	Assign standby mode switch digital input - see DIA	0	-1	2	-	S	NO
Stt	Maximum time for standby status	0	0	240	min	S	NO

Switch to clean status (par. DIn)

Clean status is an intermediate state between ON and OFF: control is interrupted, the solenoid valve is closed (0%), and only the probe fault alarms remain active. ON status (normal operation) resumes after the time CLt has elapsed, after switching off (OFF status) or when the controller is restarted.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIn	Assign clean mode switch digital input - see DIA	0	-1	2	-	S	NO
CLt	Max time for clean status	0	0	999	min	U	NO

The meaning of each status, OFF, ON, standby and clean, is summarised in the following table:

	Unit OFF	Unit ON	Standby	Clean
Control	OFF	ON	OFF	OFF
Light	independent	independent	independent	independent
Probe fault alarms	enabled	enabled	enabled	enabled
Other alarms	disabled	enabled	enabled	disabled
User terminal	OFF	based on /t1	Stb	CLn

Tab. 5.f

Change working set (par. DIo)

In this case, it is possible to choose between configuration 1 (digital input not active) and configuration 2 (digital input active). The changeover between sets occurs during the transition in status.

Important: when changing sets, the default parameters for the chosen configuration are loaded, and any settings made by the user will be overwritten.

Notice: use the configuration software to set the two default configurations. (see "Installation").

Code	Description	Def	Min	Max	UOM	User	User terminal
DIo	Assign working parameter set change digital input - see DIA	0	-1	2	-	S	NO

Door switch without stopping control (par. DIP)

Operating mode that allows the door to be opened without stopping control. In this case, when opening the door, only the light will switch on. This operating mode can be configured by setting parameter DIP with one of the digital inputs. Opening the door introduces a temperature alarm delay as described for the door switch function (par. DIE).

Code	Description	Def	Min	Max	UOM	User	User terminal
DIP	Assign door switch without control stop digital input - see DIA	0	-1	2	-	S	NO

Start/stop defrost from digital input (par. DIr)

If configured in this new mode, a digital input can be used to start a defrost when closing and end the defrost when opening (independently of par. d0). If the defrost ends after the maximum time (par.dP1), alarm Ed1 is activated if enabled (r3 = 1).

Code	Description	Def	Min	Max	UOM	User	User terminal
DIr	Assign defrost according to DI status digital input - see DIA	0	-1	2	-	S	NO
dP1	Maximum defrost duration	45	1	240	min	S	YES
r3	End defrost by timeout signal 0/1 = disabled/enabled	0	0	1	-	S	NO

5.1.3 Analogue outputs

MPXzero Advanced (VCC frequency version) has the following analogue outputs: Y1, Y2, either 0-10 V or PWM. The analogue outputs set as PWM can be used as a control signal to manage loads such as modulating evaporator fans or anti-sweat heaters, and require connection to a solid state relay (SSR).

Notice: for VCC frequency control, output Y1 is by default used to control the VCC compressor. Output Y2 remains available and configurable for other specific functions.

Code	Description	Def	Min	Max	UOM	User	User terminal
/AA	Assign analogue output for modulating evaporator fans 0 = not configured 1 = analogue output 1 (Y1) 2 = analogue output 2 (Y2)	0	0	2	-	M	NO
/Ac	Assign analogue output for modulating anti-sweat heaters - see /AA	0	0	2	-	M	NO
/AE	Assign analogue output for modulating condenser fans	0	0	2	-	M	NO
/AG	Assign analogue output for modulating compressor	0	0	2	-	M	NO

5.1.4 Digital outputs

MPXzero Standard and Advanced have 3 and 4 digital outputs respectively: NO1, NO2, NO3 and NO4. To associate the digital outputs with the available functions, set parameters DOA, DOb, ... DOq to the value of the physical digital output. See the parameter table.

Digital output functions

Digital output assignment for:	Par.	Default
Solenoid/compressor	DOA	Digital output 3 (NO3)
Alarm	DOb	-
Auxiliary	DOc	-
Auxiliary serving the Main on the Secondary devices	DOd *	-
Light	DOE	Digital output 4 (NO4)
Light serving the Main on the Secondary devices	DOF *	-
Defrost	DOG	Digital output 1 (NO1)
Auxiliary evaporator defrost	DOH	-
Compressor alarm management	DOK	
Evaporator fans	DOI	Digital output 2 (NO2)
Output associated with the timer function	DOo	-
Condensate drain heater	DOP	-
Anti-sweat heater	DOQ	-
Generic On/Off function (stage)	DOS	-
Maximum speed for two-speed fans	DOt	-
Minimum speed for two-speed fans	DOu	-
Hot gas defrost valve (VCC version only)	DOAA	-
Condenser fans (VCC version only)	DOAB	-
Liquid valve for pump-down (VCC version only)	DOn	-

Tab. 5.g

* = MPXzero Advanced only

If the opposite logic to the default setting is required, or to correct a wiring error, the logic of the functions associated with the digital outputs using parameters rOA, rOb, ... rOp can be reversed.

Code	Description	Def	Min	Max	UOM	User	User terminal
rOA, rOb, ...,rOS	Digital output logic ... 0 = direct, 1 = reverse	0	0	1	-	M	NO

Important: report the changes on diagrams, connection labels and in the user manuals.

Solenoid/compressor (par. DOA)

This allows the liquid solenoid valve to be used in applications with thermostatic expansion valves

Code	Description	Def	Min	Max	UOM	User	User terminal
DOA	Assogn solenoid/compressor digital output	3	0	4	-	S	NO

Val.	Desc.
0	not configured
1	digital output 1 (NO1)
2	digital output 2 (NO2)
3	digital output 3 (NO3)
4	digital output 4 (NO4)

Alarm (par. DOb)

The relay associated with the alarm function can work as follows:

- normally de-energised: the relay is energised when an alarm occurs (rOb = 0);
- normally energised: the relay is de-energised when an alarm occurs (rOb = 1);

Notice: operation with the relay de-energised (rOb = 0) when an alarm occurs ensures maximum safety when the alarm is due to a power failure or power cable disconnection.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOb	Assign alarm digital output - see DOA	0	0	4	-	S	NO

Auxiliary (par. DOc)

The actuator can be activated/deactivated using a command from the supervisor and based on the changeover in day/night status (linked to the curtain switch or the setting of the time bands); activation/deactivation of the actuator is signalled by the AUX icon switching on/off. The AUX output to be activated or deactivated based on the night/day time band can be selected (see parameters tS1...8, tE1...8 and H9).

Code	Description	Def	Min	Max	UOM	User	User terminal
DOc	Assign auxiliary digital output - see DOA	0	0	4	-	S	NO
H9	Output switched with time bands 0 = Light 1 = AUX	0	0	1	-	S	NO

Auxiliary serving the Main on the Secondary devices (par. DOd) *

From the Main controller, the action of the auxiliary output is broadcast via LAN to the Secondary devices whose digital output is configured with DOd greater than 0.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOd	Assign auxiliary digital output serving the Main on the Secondary devices - see DOA	0	0	4	-	S	NO

* = MPXzero Advanced only

Light (par. DOE)

The actuator can be activated/deactivated directly using the functions on the user terminal, using a command from the supervisor and based on the changeover in day/night status (linked to the curtain/door switch or the setting of the time bands); activation/deactivation of the actuator is signalled by the light icon switching on/off. The light output to be activated or deactivated based on the night/day time band can be selected (see parameters tS1...8, tE1...8 and H9).

Code	Description	Def	Min	Max	UOM	User	User terminal
DOE	Assign auxiliary digital output serving the Main on the Secondary devices - see DOA	4	0	4	-	S	NO

Light serving the Main on the Secondary devices (par. DOF) *

From the Main, the action of the light output is broadcast via LAN to the Secondary devices whose digital output is configured with DOF greater than 0. Activation (or deactivation) of the actuator is signalled by the light icon switching on (off) on the Secondary user terminal.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOF	Assign light digital output serving the Main on the Secondary devices - see DOA	0	0	4	-	S	NO

* = MPXzero Advanced only

Defrost (par. DOG)

The actuator is activated/deactivated based on the defrost settings (see the paragraph "Defrost"). Activation/deactivation of the actuator is signalled by the defrost icon switching on/off on the user terminal.

Auxiliary evaporator defrost (par. DOH)

A heater can be activated for defrosting the main and auxiliary evaporator.

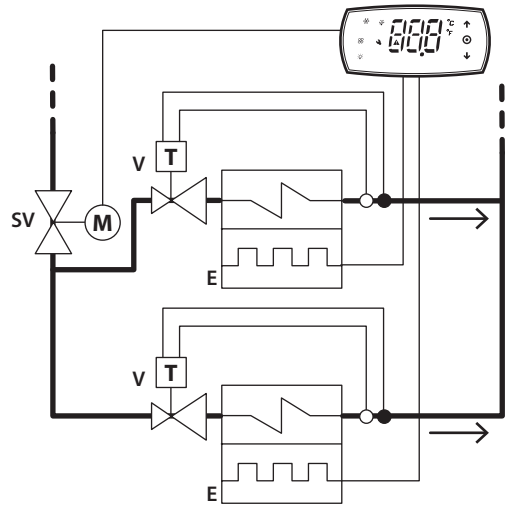


Fig. 5.d

Ref.	Description
E	Evaporator with electric defroster
V	Thermostatic expansion valve
SV	Solenoid valve

MPXzero can manage defrosts with one or two outputs and one or two end defrost probes. The table below summarises the possible cases:

Defrost outputs	Evaporator probes	Control
1	1	normal
2	1	defrost managed on two outputs with reference to the same evaporator probe
1	2	defrost managed on the same output with reference to the two evaporator probes (minimum evaporation temperature)
2	2	defrost managed independently on the two evaporator circuits

Tab. 5.h

Code	Description	Def	Min	Max	UOM	User	User terminal
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	3	-	S	YES
/FF	Assign defrost temperature probe 2 (Sd2) - see /FA	0	-4	3	-	S	NO
DOG	Assign defrost digital output - see DOA	1	0	4	-	S	NO
DOH	Assign auxiliary evaporator defrost digital output - see DOA	0	0	4	-	S	NO

Evaporator fans (par. DOI)

Once the digital output has been selected, the evaporator fan on/off is signalled by the the evaporator fan icon switching on/off on the display. See the paragraph "Evaporator fans"

Code	Description	Def	Min	Max	UOM	User	User terminal
DOI	Assign light digital output serving the Main on the Secondary devices - see DOA	2	0	4	-	M	NO

Auxiliary compressor without rotation (par. DOk)

Select the output for the auxiliary compressor without rotation (see "Control"). This output can be set to activate an auxiliary compressor as a second control step, without rotation, i.e. always starting after the main compressor.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	4	-	S	NO

Condensate drain heater (par. DOP)

During defrosting there may be frozen condensate on the bottom of the cabinet that prevents the water thawed from the evaporator from being drained correctly. The digital output can be configured to manage the condensate drain heater function. The heater is started on activation of the pump down stage and stays on throughout the defrost procedure, until the end of the dripping phase. The heater can be activated by selecting a digital output with par. DOP.

Notice: the heater must be protected against overheating (e.g. thermal protector).

Code	Description	Def	Min	Max	UOM	User	User terminal
DOP	Assign drain heater digital output - see DOA	0	0	4	-	M	NO

Anti-sweat heater (par. DOQ)

Select the digital output for demisting the glass (control with fixed activation, see the paragraph "Anti-sweat heaters").

Code	Description	Def	Min	Max	UOM	User	User terminal
DOQ	Assign anti-sweat heater digital output - see DOA	0	0	4	-	S	NO

Generic On/Off stage function (par. DOS)

Select the digital output for configuring a generic stage function.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOS	Assign generic stage function digital output - see DOA	0	0	4	-	S	NO

Maximum speed of two-speed evaporator fans (par. DOt)

For two-speed fans (generally with three wires), the digital output to be assigned to maximum speed can be selected.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOt	Assign digital output for maximum fan speed	0	0	4	-	S	NO

Minimum speed of two-speed evaporator fans (par. DOu)

For two-speed fans (generally with three wires), the digital output to be assigned to minimum speed can be selected.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOu	Assign digital output for minimum fan speed	0	0	4	-	S	NO

5.2 Control

Introduction

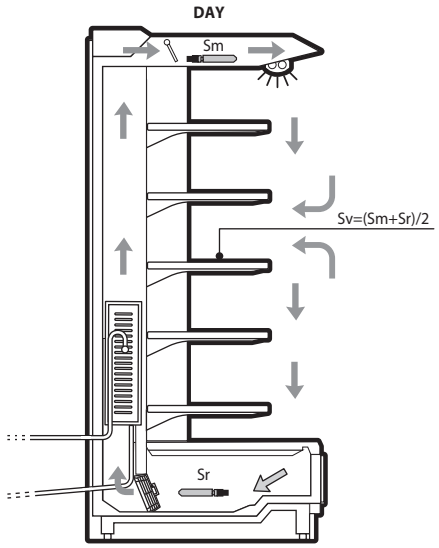
There are various modes for controlling air temperature for the preservation of foodstuffs in cold rooms and showcases. The following figure shows the position of the intake probe Sr and the outlet probe Sm. To control the temperature using the average between outlet and intake, configure the virtual probe Sv that, based on the setting of parameter /4, will provide the value given by the formula:

$$Sv = \frac{Sm \cdot (100 - /4) + Sr \cdot (/4)}{100}$$

Code	Description	Def	Min	Max	UOM	User	User terminal
/4	Virtual probe composition 0 = Outlet probe Sm 100 = Intake probe Sr	0	0	100	%	S	NO

For example, if /4=50, Sv=(Sm+Sr)/2 represents an estimated value of the air temperature around the refrigerated food.
Notice for HACCP: parameter /4 can be set to change the temperature used for control and for display. This operation may be prohibited by HACCP procedures or require record keeping and authorisation.

Example: vertical showcase



Ref.	Description
Sm	Outlet probe
Sr	Intake probe
Sv	Virtual probe

Fig. 5.e

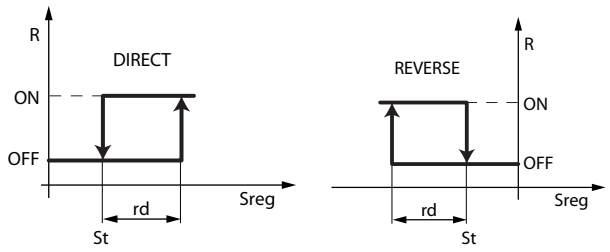
During the day, most of the load in a refrigerated showcase is due to warm air that enters from the outside and mixes with the cold air inside. Control based on the intake probe, due to high temperature outside the showcase and the mixing of the air, may not manage to reach the set point. Displaying the intake temperature would show a temperature that is too high. Setting a set point that is too low for the intake probe Sr may cause the food to freeze. On the other hand, displaying the outlet temperature would show a temperature that is too low. Consequently, the display of the control probe, set point or virtual probe can be configured using parameter /t1. ON/OFF control on the outlet probe is defined by:

- set point;
- differential

These values determine the control request and consequently, allowing for the protection times, disabling functions or activation/deactivation delays, the opening/closing of the solenoid valve.

Code	Description	Def	Min	Max	UOM	User	User terminal
St	Set point	50	r1	r2	°C/°F	U	YES
rd	Differential	2	0.1	99.9	°C/°F	U	YES
rC	Operating mode 0/1 = Direct/Reverse	0	0	1	-	U	NO

Notice for HACCP: the set point and differential are critical parameters for food storage. Modifications to these settings may be prohibited by HACCP procedures or require record keeping and authorisation.



Ref.	Description
St	Set point
rd	Differential
Sreg	Control probe
R	Control request

Fig. 5.f

ON/OFF control depends on the capacity of the produce to absorb and release heat, as well as on the evaporator cooling time. The temperature therefore fluctuates above and below the set point, and this may cause a decline in the quality of food preservation. Decreasing the differential to make control more precise increases the frequency of solenoid valve opening/closing cycles.
Setting parameter rC=1 enables reverse operation, suitable for hot cabinet applications.

Minimum and maximum set point values (parameters r1 and r2)

The minimum and maximum value of the set point can be set by parameter.

Code	Description	Def	Min	Max	UOM	User	User terminal
r1	Minimum set point	-50	-50	r2	°C/°F	M	NO
r2	Maximum set point	50	r1	200	°C/°F	M	NO

Night-time operation

During night-time operation the curtain on the display case is closed and consequently less cold inside air is mixed with warm outside air. The thermal load decreases. The temperature of the air that cools the produce is near the outlet temperature, and therefore to avoid excessively low temperatures and reduce energy consumption, the set point needs to be increased at night, by setting parameter r4. Parameter r6 can then be used to assign the virtual probe Sv or intake probe Sr as the control probe. Naturally, the change to night-time operation must be signalled externally. This is usually done using the curtain switch, set with parameter DIG, signalling that the curtain has been lowered, or by setting the time bands (parameters tS1 to tS8 and tE1 to tE8), from the supervisor, or from the Main controller via the Main/Secondary network. To set the time bands, see "Setting the day/night time bands".

Code	Description	Def	Min	Max	UOM	User	User terminal
r4	Automatic night set point variation	0	-50	50	°C/°F	S	NO
r6	Night control probe 0/1 = virtual probe Sv/intake probe Sr	0	0	1	-	S	NO
tS1..8-d	Start time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	S	NO
tS1..8-hh	Start time band 1 to 8 day: hours	0	0	23	hours	S	NO
tS1..8-mm	Start time band 1 to 8 day: minutes	0	0	59	minutes	S	NO
tE1..8-d	End time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-hh	End time band 1 to 8 day: hours	0	0	23	hours	S	NO
tE1..8-mm	End time band 1 to 8 day: minutes	0	0	59	minutes	S	NO

Notice for HACCP: verify that modification of the night-time set point (parameter /4) is permitted by site HACCP procedures. If required, obtain the required authorisation and record the changes.

Variable	Daytime control	Night-time control	
		r6 = 0	r6 = 1
Control probe (Sreg)	Virtual probe (Sv)	Virtual probe (Sv)	Intake probe (Sr)
Set point	St	St+r4	

Tab. 5.i

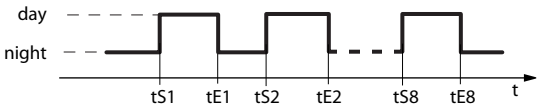


Fig. 5.g

During day status:
- Set point = St
- light on
- control on virtual probe Sv During night status:
- Set point = St + r4
- light off
- control on Sr (if r6=1) or on Sv (if r6=0)

"Weighted control" and "double thermostat" can be used for automatic changeover to night-time operation without an external signal.

"Weighted control" (or on virtual probe Sv)

This function compensates for the disadvantages of control based solely on the outlet probe or the intake probe. The control probe becomes the virtual probe:

$$Sv = \frac{Sm \cdot (100 - /4) + Sr \cdot (/4)}{100}$$

The weighted average of the outlet and intake probes is used to compensate for the mixing of air from outside the showcase. Normally the weight of /4 is set to 50% and the value of the virtual probe can be chosen for both display and temperature recording.

The value of the virtual probe thus becomes the mean value of the outlet and intake probes and the measurement that best corresponds to the produce temperature. Another advantage is automatic adaptation to night-time operation with the curtain closed, without needing an external signal. When the curtain is open there is immediately an increase in load on the evaporator, consequently the outlet temperature is lowered so as to keep the average temperature constant.

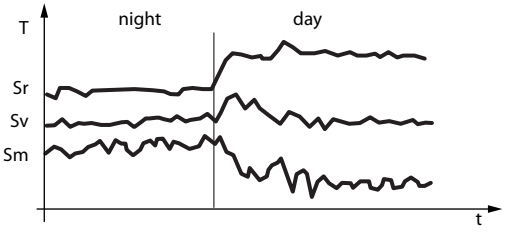


Fig. 5.h

Ref.	Description
T	temperature
t	time
Sr	Intake probe
Sv	Virtual probe
Sm	Outlet probe

Shared network solenoid

For applications where the solenoid valve is installed only on the Main controller, the solenoid output can be configured as a network solenoid output: r7=1 on the Main and Secondary devices. The valve on the Main controller will be open when there is a cooling request on any of the Secondary controllers.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOA	Select digital input broadcast from Main to Secondary devices (only on Main)	3	0	4	-	S	NO

Val.	Desc.	Val.	Desc.
0	not configured	3	digital output 3 (NO3)
1	digital output 1 (NO1)	4	digital output 4 (NO4)
2	digital output 2 (NO2)		

r7	Main solenoid valve configuration 0/1 = local valve/network valve (connected to Main)	0	0	1	-	S	YES

If configured as the network solenoid, the valve is:
- open: if at least one of the controllers requires cooling;
- closed: if no controller has a refrigeration request or if at least one of the controllers has a serious alarm

Notice: on Main/Secondary networks with a shared solenoid valve, parameter r7 must be correctly set on all of the devices (r7=1).

ON/OFF (par. ON

Parameter ON is used to switch the controller ON/OFF. If there is a digital input configured as remote ON/OFF, this has higher priority than the supervisor command or the ON parameter.

Code	Description	Def	Min	Max	UOM	User	User terminal
P10	ON/OFF command - 0=OFF, 1=ON	1	0	1	-	S	YES

In this operating mode, the display shows the standard display, alternating with the message "OFF".
When OFF, the following are possible:
- access the parameters on the user terminal;
- activate remote ON/OFF;
- display the probe alarms (rE, E1, E2, E3, etc.) and errors EE, EF, Etc, Edc, alternating with the message OFF.

When OFF, the following alarms are reset:
- high and low temperature;
- open door alarm (dor);

Double thermostat

The double thermostat function is activated by setting parameter rd2> 0 and selecting mode AND or OR logic mode (parameter db1). It is used to automatically adapt, that is, without changing the set point and without an external signal, control of the unit based on a change in compressor load, especially when switching from day to night and vice-versa. In fact, at night the showcase curtains are closed, there is less heat exchange with the surrounding air and the compressor works less.
To do this, two set points and two differentials are defined:

- St and rd, associated with the outlet probe;
- St2 and rd2, associated with the intake probe.

Code	Description	Def	Min	Max	UOM	User	User terminal
St2	Intake probe set point with double thermostat	50	r1	r2	°C/°F	S	NO
rd2	Set point St2 differential with double thermostat 0.0 = function disabled	0	0	99.9	°C/°F	S	NO
db1	Double thermostat function logic 0/1 : logical AND/logical OR	0	0	1	-	M	NO

The control request occurs:

- when this is active on both probes, as if there were two thermostats in series, when db1 = 0
- when one of the probes signals the request, as if there were two thermostats in parallel, when db1 = 1.

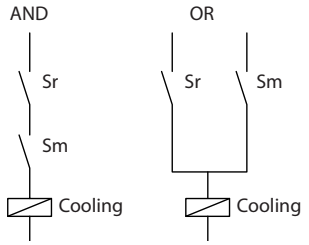


Fig. 5.i

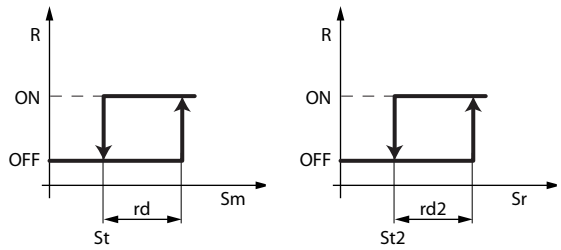


Fig. 5.j

Ref.	Description
Sm	outlet probe
Sr	intake probe
R	control request
rd	differential for St
rd2	differential for St2

Below is an example of the temperature trend on a vertical showcase during the day and at night.

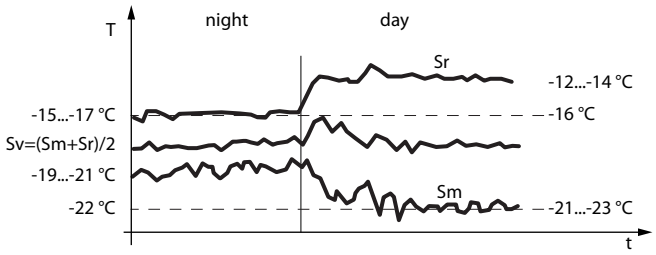
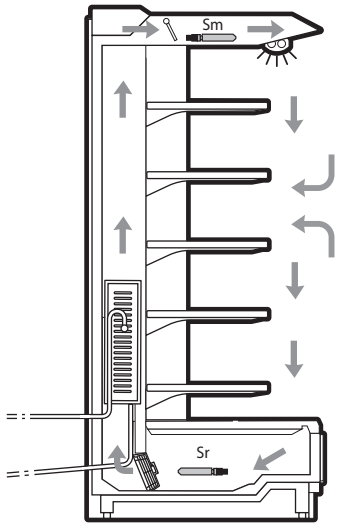


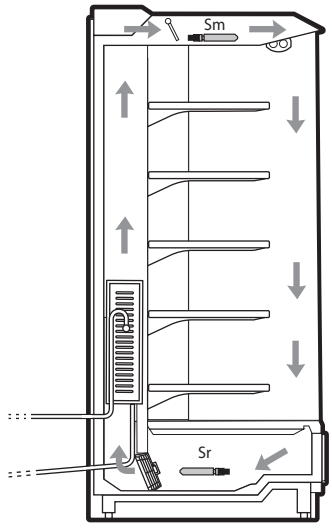
Fig. 5.k

Ref.	Description
Sm	outlet probe
Sr	intake probe
T	temperature
Sv	virtual probe
t	time



Sr = - 12 to -14°C, St = -16°C

Fig. 5.l



Sr = - 17 to -15°C, St = -16°C

Fig. 5.m

Ref.	Description
Sm	outlet probe
Sr	Intake probe

Notice:

- if one of the probes has an error or is missing, it is considered as signalling the request;
- if both probes are faulty or missing, the controller switches to duty setting mode.

Important: if the double thermostat function is activated, the setting of the following parameters has no effect:
- r6 (night-time control probe);
- r4 (automatic night-time set point variation).

Control offset with probe error (parameter ro)

Code	Description	Def	Min	Max	UOM	User	User terminal
ro	Control offset with probe error	0	0	20	°C/°F	S	NO

MPXzero in standard mode uses the virtual probe Sv for control, that is, the weighted average of the outlet and intake probe (see parameter /4). If one of the two probes making up the virtual probe is broken or has an error, parameter ro is used to continue normal control in controlled conditions, without the need for immediate intervention by maintenance personnel. The recommended value of ro is the temperature difference between the outlet probe and intake probe reading in steady operating conditions of the refrigeration unit:

$$ro = Sr - Sm$$

The following cases may occur:
- outlet probe Sm error: MPXzero starts control based on the intake probe Sr alone, considering a new set point (St*) determined by the formula:

$$St^* = St + ro \cdot \frac{(100 - '/4')}{100}$$

- intake probe Sr error: MPXzero starts control based on the outlet probe Sm alone, considering a new set point (St*) determined by the formula:

$$St^* = St - ro \cdot \frac{'/4'}{100}$$

If night-time operation has been set with the intake probe as the control probe, the controller considers /4=100 and uses the outlet probe. The new set point becomes:

$$St^* = St - ro$$

Notice:
- if ro=0 the function is not active;
- for night-time operation the new set point is added to the value defined by r4 (= automatic night-time set point variation);
- in the event of errors on both probes, the controller switches to duty setting operation.

Example

Sm fault in daytime operation, with /4=50, St=-4, Sr=0, Sm=-8, ro (recommended) = 0-(-8) = 8. Then the new control probe will be Sr with:

$$St^* = St + ro \cdot \frac{(100 - '/4')}{100}$$

St*= -4+8 •(100-50)/100=0.

If the fault is on Sr, the new control probe will be Sm with:

$$St^* = St - ro \cdot \frac{'/4'}{100}$$

St*= -4-8 •50/100=-8.

ON time for duty setting operation (par. c4)

Duty setting is used to maintain control in emergency situations with errors involving the temperature control probes, until service is performed. In the event of a temperature probe error, MPXzero uses the other probe available and adjusts the set point according to the setting of parameter ro. In the event of errors on both probes, MPXzero switches to a special mode called "duty setting". The controller is activated at regular intervals, operating for a time equal to the value set for the duty setting parameter c4, and off for a fixed time of 15 minutes.

Code	Description	Def	Min	Max	UOM	User	User terminal
c4	ON time for duty setting operation (Toff = 15 minutes, fixed value) 0 = compressor/valve always OFF 100 = compressor/valve always ON	0	0	100	min	M	NO

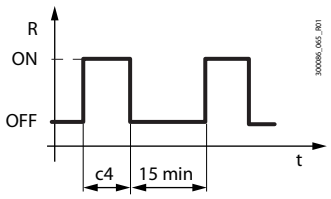


Fig. 5.n

Ref.	Description
R	Control
c4	ON time
t	Time

With duty setting active, during the ON time the solenoid/compressor icon remains on, while it flashes during the OFF time. The table below describes the possible fault situations relating to the control probes and the function that is activated.

Type of system	Control probe fault		Control	Parameter
	Sm	Sr		
1 probe	●		Duty setting	c4
		●	Duty setting	c4
2 probes	●		control on Sr	ro(*)
		●	control on Sm	ro(*)
	●	●	Duty setting	c4

Tab. 5.j

* ro must be > 0.

Duty setting with shared control status (MPXzero Advanced only)

Activation of the duty setting mode is signalled on the Main user interface with the solenoid/compressor icon on steady; the Secondary controllers ignore the Main control mode. On the other hand, if a Secondary device activates duty setting mode due to lack of communication with the Main, the Secondary manages the display on the user interface as standard.

Notice:
- activation of duty setting mode on the Main controller implies that all the related Secondary devices observe the Main controller compressor management times.
- in duty setting mode, the compressor protection times are ignored.

Notice:
- if a second ON/OFF compressor is managed with an activation delay, both compressors will start based on the set times. Parameter c4 must be set correctly in relation to the activation delay c11.

Continuous cycle (parameter cc)

Continuous cycle is a function used to keep the refrigeration cycle active continuously for a settable duration, irrespective of the temperature inside the unit. This may be useful when requiring a rapid decrease in the temperature, even below the set point. Activation of the low temperature alarm when exceeding the threshold AL or AL2 can be delayed by setting parameter c6.

Important: the time defined by parameter cc is in hours, the alarm delay c6 is in minutes.

Code	Description	Def	Min	Max	UOM	User	User terminal
cc	Continuous cycle running time, 0 = Disabled	0	0	15	hours	M	NO
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	NO

The continuous cycle can be activated using the direct continuous cycle function on the user terminal (see "Direct functions"), from the supervisor or via digital input. When the continuous cycle is running:
- the ❄ + 🔧 icons are displayed.
- the solenoid valve/compressor output (with icon) is activated;
- the low temperature alarm with threshold AL is enabled relating to the probe defined by parameter AA as well as the low temperature alarm with threshold AL2 relating to the probe defined by parameter AA2.

Important: for correct activation of the low temperature alarms, set the parameters as follows:
- AA = outlet probe;
- AA2 = intake probe.

Notice:

1. the continuous cycle cannot be activated if:
   - the duration of the continuous cycle is set to 0 (cc=0);
   - the measurements of the probes defined by AA and AA2 have exceeded their respective thresholds AL, AL2;
   - the device is OFF.
2. The continuous cycle remains in standby if:
   - the compressor protection times are set (c1, c2, c3);
   - the immediate or delayed alarm from external digital input delays activation of the solenoid valve;
   - defrost, dripping, post-dripping are running;
   - the door is open. When the door is opened, the continuous cycle is interrupted. It restarts for the remaining time when the door is closed.
3. The continuous cycle ends:
   - when deactivating the direct function from the user terminal (see "Direct functions");
   - when reaching the low temperature threshold (AL or AL2 in double thermostat mode), whichever is reached first;
   - at the end of the time cc;
   - when the controller is switched off from the supervisor (logical OFF);
   - from the supervisor.

Notice: if a second ON/OFF compressor is managed with an activation delay, during continuous cycle both compressors will start based on the set times.

Continuous cycle with shared control status

This operating mode is highlighted on the Main user interface by the corresponding icons on steady; the Secondary controllers ignore the Main control mode and manage the display as normal (solenoid icon on during the cooling request and off when there is no request).

Defrost priority over continuous cycle

Code	Description	Def	Min	Max	UOM	User	User terminal
c7	Defrost priority over continuous cycle 0=No, 1=Yes	0	0	1	-	M	NO

If c7=0 the defrost and continuous cycle are not mutually interruptible (same priority): any defrost or continuous cycle request remains pending if activated when running the other procedure. If c7=1 the defrost calls activated when the continuous cycle is running terminate the latter and activate the defrost.

5.3 Defrost

Introduction

Parameters td1 to td8 can be used to set up to 8 defrost events based on the controller clock (RTC) and to activate the power defrost (see the end of the paragraph).
To set parameters td1 to td8, use the supervisor or the "Applica" app.

Code	Description	Def	Min	Max	UOM	User	User terminal
td1..8-d	Defrost 1 to 8 - day 0 = event disabled 1 to 7 = Monday to Sunday 8 = Monday to Friday 9 = from Monday to Saturday 10 = Saturday & Sunday 11 = every day	0	0	11	day	S	NO
td1..8-hh	Defrost 1 to 8 - hours	0	0	23	hours	S	NO
td1..8-mm	Defrost 1 to 8 - minutes	0	0	59	minutes	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0/1 = normal/power defrost	0	0	1	-	S	NO

MPXzero can manage different types of defrosts, depending on the setting of parameter d0.
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 phase reaches the maximum time dP1.

End defrost in advance due to high temperature

MPXzero can end the defrost in advance if the value measured by a configurable probe exceeds a certain maximum value; this helps prevent, especially with electric heater defrosts, the temperature inside the showcase or cold room from climbing too high. If the defrost ends in advance, the controller shows the corresponding signal (dEA) on the display, which will be cleared only when the next defrost ends correctly.

Code	Description	Def	Min	Max	UOM	User	User terminal
dEP	Assign probe for end defrost in advance 0 Not configured 1 Air off-outlet (Sm) 2 Defrost (Sd) 3 Air on-intake (Sr) 4 Auxiliary defrost (Sd2) 5 Auxiliary 1 (Saux1) 6 Auxiliary 2 (Saux2) 7 Ambient temp (SA) 8 Ambient humidity (SU) 9 Glass temperature (Svt) 10 Dew point (SdP) 11 Virtual probe (Sv)	0	0	11	-	S	NO
dET	Temperature threshold for end defrost in advance	50	-99.9	99.9	°C	S	NO

At the end of the defrost the dripping phase can be enabled (if dd>0), during which the solenoid valve is closed and the fans are off, followed by the post-dripping phase (if Fd>0), during which control resumes and the fans work based on the setting of par. Fpd. The type of display on the user terminal during defrosting can be selected by setting parameter d6.

Notice: high temperature alarms can be disabled after defrosting by setting par. d8.

Code	Description	Def	Min	Max	UOM	User	User terminal
d0	Type of defrost 0 heater by temperature 1 hot gas by temperature 2 heater by time 3 hot gas by time 4 heater by time with temperature control	0	0	4	-	S	YES
dt1	End defrost temperature (read by Sd)	8	-50	50	°C/°F	S	YES
dP1	Maximum defrost duration	45	1	240	min	S	YES
d6	Display on terminals during defrost 0 = temperature alternating with 'dEF' 1 = freeze display 2 = 'dEF'	1	0	2	-	U	NO
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	NO
F3	Evaporator fan status during defrost 0 = on, 1 = off	1	0	1	-	S	F3
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	NO
Fpd	Evaporator fans during post-dripping 0=On, 1=Off	0	0	1	-	0	NO

Below is the trend of the defrost output based on the setting of parameter d0.

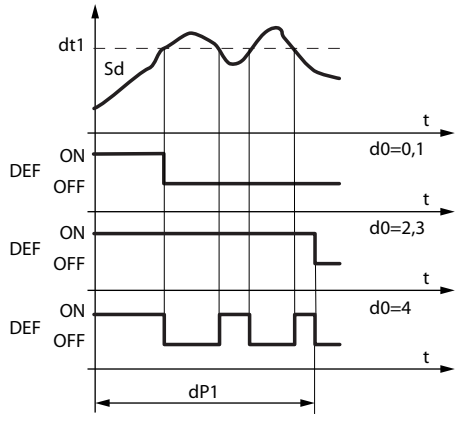


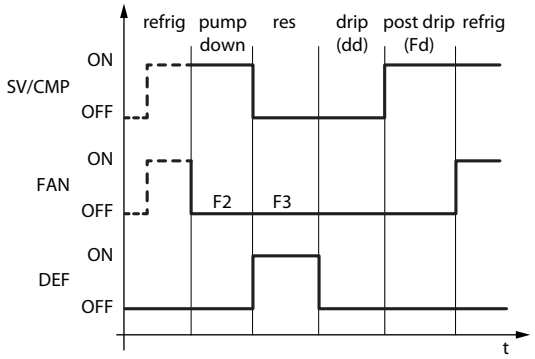
Fig. 5.o

Ref.	Description
t	Time
dt1	End defrost temperature
dP1	Maximum defrost duration
Sd	Defrost probe
DEF	Defrost

The heater defrost by time with temperature control (d0=4) activates the defrost output only if the evaporator temperature (Sd) is less than the value of parameter dt1, and ends after the time defined by dP1. This function is useful for energy saving and to prevent excessive temperatures on the evaporator with timed defrosts.

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

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



Ref.	Description
t	Time
FAN	Fan
DEF	Defrost
drip	Dripping
SV/CMP	Solenoid/compressor
Post drip	Post-dripping

Fig. 5.p

The pump down phase is the period in which the evaporator is emptied of liquid refrigerant, and can be disabled by setting dH1=0 (see "Pump down duration").
Operation of the fan during the pump down phase depends on parameters F2 and F3.
During the dripping phase the fan is always off, while during the post-dripping phase operation depends on the setting of parameter Fpd.

Code	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time after defrost (fans off) 0 = no dripping	2	0	15	min	S	NO
dH1	Pump down duration 0 = pump down disabled	0	0	999	s	M	NO
F2	Evaporator fans with compressor off 0 = see F0 1 = always off	1	0	1	-	S	YES
F3	Evaporator fans during defrost 0 = on, 1 = off	1	0	1	-	S	F3
Fd	Post-dripping time after defrosting (fans off with control active)	2	0	15	min	S	NO

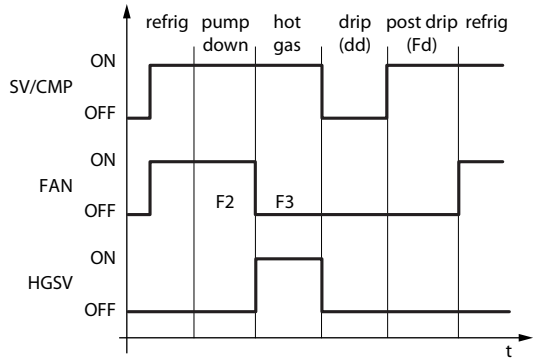
5.3.2 Hot gas defrost (d0 = 1, 3): duty cycle

MPXzero can manage defrosts by installing a hot gas injection solenoid valve.
This type of defrost can be controlled in two ways:

- Hot gas by temperature (d0=1);
- Hot gas by time (d0 = 3).

In the former case, the defrost ends when reaching the temperature set for parameter dt1 (end defrost threshold (read by Sd)).
In the latter case, the defrost ends after a set time (parameter dP1 = maximum defrost duration).

Notice: parameter dP1 is also taken into account when end defrost by temperature is selected. If the threshold dT1 is not reached, the defrost will end after the maximum duration (dP1).



Ref.	Description
t	Time
FAN	Fan
HGSV	Hot gas valve
drip	Dripping
SV/CMP	Solenoid/compressor
post drip	Post-dripping

Fig. 5.q

The pump down phase is the period in which the evaporator is emptied of liquid refrigerant, and can be disabled by setting dH1=0 (see "Pump down duration"). In the hot gas defrost phase, the solenoid valve for hot gas injection (HGSV) is opened. Operation of the fan during the pump down and hot gas phases depends on parameters F2 and F3. During the dripping phase, the fan is always off, while during the post-dripping phase operation depends on the setting of parameter Fpd.

5.3.3 Advanced parameters

Maximum interval between consecutive defrosts (par. dI)

Code	Description	Def	Min	Max	UOM	User	User terminal
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	YES

Parameter dI is a safety parameter used to perform cyclical defrosts every "dI" hours. It is also useful if the LAN or RS485 serial network is disconnected. At the start of each defrost, irrespective of the duration, an interval starts being counted. If this interval exceeds dI without a defrost being performed, one is started automatically. The count is always active even if the controller is OFF. If set on the Main controller, the parameter affects the entire connected LAN subnet, while if set on a Secondary controller, it only has an effect locally.

Example
If the defrosts are controlled by a centralised system and there is no communication, the request will not be received, so after the safety time a defrost is started automatically.

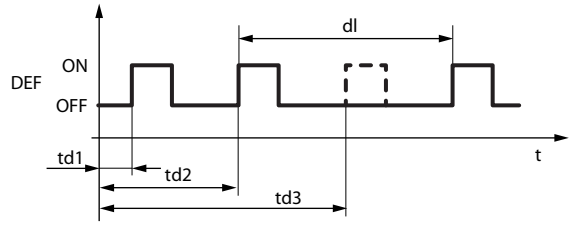


Fig. 5.r

Ref.	Description
dI	Maximum interval between consecutive defrosts
td1…td3	Scheduled defrosts
t	time
DEF	Defrost

Staggered defrosts

This function is used to perform a series of daily defrosts by setting just the first using parameter td1 and then indicating the number of defrosts per day using parameter d1S. The controller automatically schedules all the defrosts to be performed at regular intervals over the 24 hours following the event defined by td1. The same applies to td2 and dS2.

Code	Description	Def	Min	Max	UOM	User	User terminal
d1S	Number of daily defrosts (td1) 0 Disabled; 5 4 hours and 48 minutes; 10 2 hours and 24 minutes 1 24 hours and 0 minutes; 6 4 hours and 0 minutes; 11 2 hours and 11 minutes 2 12 hours and 0 minutes; 7 3 hours and 26 minutes; 12 2 hours and 0 minutes 3 8 hours and 0 minutes; 8 3 hours and 0 minutes; 13 1 hour and 0 minutes 4 6 hours and 0 minutes; 9 2 hours and 40 minutes; 14 30 minutes	0	0	14	-	S	NO
d2S	Number of daily defrosts (td2) - see d1S	0	0	14	-	S	NO

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

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

Notice:
- if event td1 includes a series of days, the programming always ends at 24.00 on the last day. If event td1 includes one day only, the programming ends at 24.00 on the same day;
- if both td1 and td2 are set, when the defrost events overlap, only the sequence of defrosts that start first are performed..

Start/end defrost synchronised by Main (par. d2, d3)

These parameters determine whether or not, in a local network, MPXzero awaits a start/end defrost signal from the Main controller at the start/end of the defrost.

Code	Description	Def	Min	Max	UOM	User	User terminal
d2	End defrost synchronised by Main 0 = not synchronised 1 = synchronised	1	0	1	-	S	NO
d3	Send start network defrost signal (for Main) 0 = Yes, 1 = No Ignore start network defrost signal (for Secondary) 0 = No, 1 = Yes	0	0	1	-	S	NO

End defrost by timeout signal (par. r3)

For defrosts that end by temperature (d0=0), this enables the end defrost by timeout signals Ed1 and Ed2 when the maximum time is reached (dP1).

Code	Description	Def	Min	Max	UOM	User	User terminal
r3	End defrost by timeout signal 0 = disabled, 1 = enabled	0	0	1	-	S	NO

Defrost at power on (par. d4)

The defrost call at power-on has priority over the control request and activation of the continuous cycle. For Main controllers, the defrost at power-on will be a network defrost, while it will be ignored on Secondary controllers where d3=0; for Secondary controllers it will be local.

Code	Description	Def	Min	Max	UOM	User	User terminal
d4	Defrost at power on (Main = network defrost; Secondary = local defrost) 0 = No, 1 = Yes	0	0	1	-	S	NO

Defrost delay at power on (parameter d5)

Also active when d4=0. If the digital input is set to enable or start a defrost from an external contact, parameter d5 represents the delay between when the defrost is enabled or called, and when it effectively starts.

Code	Description	Def	Min	Max	UOM	User	User terminal
d5	Defrost delay at power-on or (for Secondary) after control signal from Main 0 = delay disabled	0	0	240	min	S	NO

For Main/Secondary networks where the defrost needs to be activated from a digital input on the Main, it is recommended to use parameter d5 to delay the various defrosts, thus avoiding current overloads.

Dripping time after defrost (par. dd)

This parameter defines the time that the compressor and the evaporator fans stop following a defrost so as to allow the evaporator to drip. If dd=0 no dripping time is enabled, and at the end of the defrost control resumes immediately, without stopping the compressor and the fan, if active.

Code	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time after defrost (fans off) 0 = no dripping	2	0	15	min	S	NO

Pump down duration (par. dH1)*

The pump down phase is the period in which the evaporator is emptied of liquid refrigerant. Parameter dH1 defines the duration of the pump down phase during all types of defrost.

Code	Description	Def	Min	Max	UOM	User	User terminal
dH1	Pump down duration 0 = pump down disabled	0	0	999	s	M	NO

*for the VCC version see the specific section of the manual.

⚠ **Important:** the controller does not have two separate outputs to manage the compressor and solenoid valve.

Running time defrost (par. d10, d11)

Running time is a 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.

Notice: d11 should be set to a temperature that is lower than the value normally expected on the evaporator in normal operation.

Code	Description	Def	Min	Max	UOM	User	User terminal
d10	Defrost time in running time mode 0 = function disabled	0	0	240	min	S	NO
d11	Defrost temperature threshold in running time mode	-30	-50	50	°C/°F	S	NO

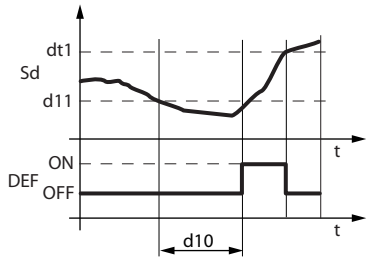


Fig. 5.s

Ref.	Description
Sd	Defrost probe
DEF	Defrost
t	time

Defrost by temperature differential and time (par.dd1, dd2, dTd, tdd)

This function determines when the refrigeration unit needs defrosting. In particular, if the difference between two probe readings (dd1, dd2) is higher than a predefined threshold (dTd) for a certain time (tdd), the evaporator may be frozen and a defrost is activated.

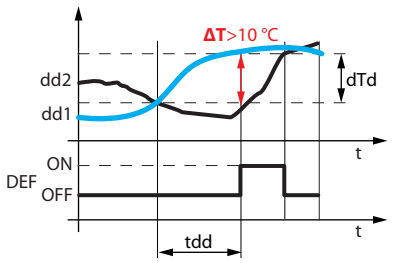


Fig. 5.t

Ref.	Description
Sd	Defrost probe
DEF	Defrost
t	time

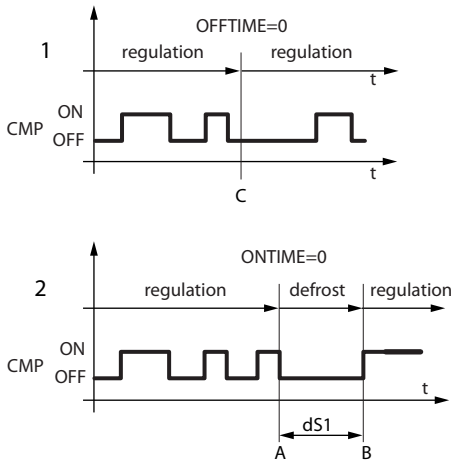
Code	Description	Def	Min	Max	UOM	User	User terminal
dd1	Assign probe 1 to determine start defrost (dd1-dd2)	11	0	11	-	S	NO
dd2	Assign probe 2 to determine start defrost (dd1-dd2)	2	0	11	-	S	NO
dTd	Temperature differential threshold to start defrost	50	-99.9	99.9	°C	S	NO
tdd	Threshold evaluation time to start defrost	60	15	240	min	S	NO

Sequential stops (par.dS1, dS2)

Sequential stop mode is especially useful for advanced temperature refrigeration units, is based on the intelligent stopping of control to allow the evaporator to defrost naturally by the flow of ambient air only, without activating the defrost output. If the function is enabled (parameter dS1>0), two countdowns are activated during normal control:

- OFFTIME: this is decreased when the unit is at the set temperature, therefore when SV/COMP = OFF. Unchanged when the unit has an active request;
- ONTIME: this is decreased when the unit has an active request, therefore when SV/COMP = ON. Unchanged when the unit is at the set temperature. Two events may occur, with reference to the following figure:
  1. OFFTIME is reset (instant C): OFFTIME and ONTIME are reset with the values dS1 and dS2 and the defrost is considered completed. Control resumes;
  2. ONTIME is reset (instant A): OFFTIME is reset with the default value and the natural defrost starts, lasting the entire time dS1. At the end of the defrost (instant B), OFFTIME and ONTIME are reset with the values dS1 and dS2 and control resumes.

Code	Description	Def	Min	Max	UOM	User	User terminal
dS1	Compressor off time in sequential stop defrost mode - 0 = function disabled	0	0	45	min	M	NO
dS2	Compressor operating time in sequential stop defrost mode	120	0	240	min	M	NO



Ref.	Description
CMP	Compressor
t	time

Fig. 5.u

The purpose is to stop control and allow natural defrosts only when necessary.
When control stops in sequential stop mode, the defrost icon will come on, the defrost status will be sent to the supervisor and the display will reflect the setting of parameter d6.

Notice: the setting of parameter F3 has no effect. Evaporator fan management depends on parameter F0.

Skip defrost (par. d7, dn)

If defrosts ending by temperature are set, the skip defrost function evaluates whether the defrost duration is less than a certain threshold dn1 (dn2) and based on this establishes whether or not the following defrosts can be skipped.

Code	Description	Def	Min	Max	UOM	User	User terminal
dP1	Maximum defrost duration	45	1	240	min	S	YES
dP2	Max auxiliary evaporator defrost duration	45	1	240	min	S	YES
d7	Skip defrost: 0 = Disabled - 1 = Enabled	0	0	1	-	M	NO
dn	Nominal defrost duration for skip defrost	75	0	100	%	M	NO

Thresholds dn1 (evaporator 1) and dn2 (evaporator 2) are calculated based on the parameter settings:

$$dn1 = \frac{dn}{100} \cdot dP1 \qquad dn2 = \frac{dn}{100} \cdot dP2$$

The algorithm keeps a counter of the defrosts to be skipped:
- at power-on, the defrost is performed 7 times without increasing the counter, from the eighth on the counter is updated.
- if the defrost ends in a time less than dn1 (dn2), the counter of the defrosts to be skipped is increased by 1;
- when the counter reaches 3, the next defrost is skipped; if the next defrost ends in a time less than dn1 (dn2), the counter is increased and the next 2 defrosts are skipped; if the next defrost also ends in a time less than dn1 (dn2), the counter is increased and the next 3 defrosts are skipped, the counter is reset and the algorithm restarts (see the table).

Defrost sequence	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Defrost duration < dn1?	-	-	-	-	-	-	-	S	S	S	-	S	-	-	S	-	-	-	S	S	S	-
Counter	-	-	-	-	-	-	-	1	2	3	-	4	-	-	5	-	-	-	1	2	3	-
Defrost skipped?	N	N	N	N	N	N	N	N	N	N	S	N	S	S	N	S	S	S	N	N	N	S
																			Restart algorithm			

Notice: if at any time the defrost ends after dn1 (dn2), the next defrost is performed and the counter is reset.

Notice: the algorithm only applies to defrosts scheduled by time bands or cyclical defrosts (par. DI); manual defrosts or those started by the supervisor are always performed and do not affect the counter.

Power defrost (par. ddt, ddP)

Power defrost is used to increase the end defrost threshold dt1 (dt2 for the second evaporator) and/or the maximum defrost duration dP1 (dP2 for the second evaporator). These increases allow more effective defrosts. Power defrosts are performed on each defrost call during night status or when suitably configured by the RTC parameters (sub-parameter P of parameters td1 to td8), so as to allow the user to choose the conditions that are most suitable for this special procedure. Power defrost is activated when at least one of the increases, ddt or ddP, has any value other than zero.

Code	Description	Def	Min	Max	UOM	User	User terminal
ddt	Additional end defrost temperature delta in power defrost mode	0	-20	20	°C/°F	S	NO
ddP	Additional maximum defrost time delta in power defrost mode	0	0	60	min	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal, 1 = power defrost	0	0	1	-	S	NO

5.4 Evaporator fans

The evaporator fans can be managed, if required, according to the temperature measured by any two of the probes connected to the MPXzero controller. The deactivation threshold is equal to the value of parameter F1, and the hysteresis is equal to the value of Frd.

Notice: during the dripping waiting time (in the event of network defrosts), and during the dripping time, the evaporator fans are always off, while during the post-dripping time, if set, evaporator fan operation depends on the setting of par. Fpd.

Fixed-speed fans

The parameters used to manage fixed-speed fans are shown below (see the connection diagram).
MPXzero manages the evaporator fans as follows:

- F0 = 0 always on;
- F0 = 1 off when the difference between the two probe values Sa and Sb (defined by parameters FSa and FSb) exceeds the threshold set for parameter F1;
- F0 = 2 on/off based on Sa probe, defined by parameter FSa.

Code	Description	Def	Min	Max	UOM	User	User terminal
F0	Evaporator fan management 0 = always on 1 = activation based on Sa - Sb (see FSa and FSb) 2 = activation based on Sa (Sa = first probe, Sb = second probe)	0	0	2	-	S	YES
F1	Evaporator fan activation threshold (only if F0 = 1 or 2)	-5	-50	50	°C/°F	S	YES
Frd	Fan activation differential (including variable speed)	2	0.1	20	°C/°F	S	YES
FSa	First fan control probe	2	0	11	-	M	NO
	0 Not config. 1						
	1 Air off-outlet (Sm)						
	2 Defrost (Sd)						
	3 Air on-intake (Sr)						
	4 Auxiliary defrost (Sd2)						
	5 Auxiliary 1 (Saux1)						
	6 Auxiliary 2 (Saux2)						
	7 Ambient temp (SA)						
	8 Ambient humidity (SU)						
	9 Glass temperature (Svt)						
	10 Dew point (SdP)						
	11 Virtual probe (Sv)						
FSb	Second fan control probe - see FSa	11	0	11	-	M	NO

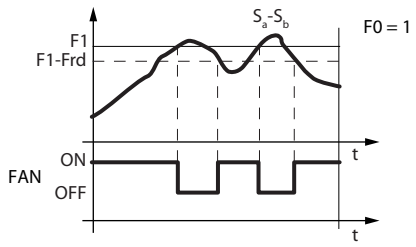


Fig. 5.v

Ref.	Description
Sa	Probe set by parameter FSa
Sb	Probe set by parameter FSb
F1	Fan activation threshold

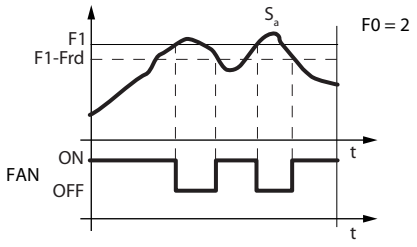


Fig. 5.w

Ref.	Description
Frd	Differential
t	time
FAN	Evaporator fans

The fans can be turned off in the following situations:
- when the solenoid valve (or compressor) is deactivated (parameter F2);
- during defrosts (parameter F3).

During the dripping time (parameter dd > 0) the fans are off, and during the post-dripping time (parameter Fd > 0), the evaporator fans are on or off depending on the value of parameter Fpd.
This is useful to allow the evaporator to return to temperature after defrosting, thus avoiding blowing warm hot and moist air into the refrigerated environment.
The evaporator fans can be forced on during control (parameter F2) and during defrosts (parameter F3).

Code	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time after defrost (fans off) 0 = no dripping	2	0	15	min	S	NO
F2	Evaporator fans with compressor off 0 = see F0 1 = always off	1	0	1	-	S	YES
F3	Evaporator fan status during defrost 0 = on, 1 = off	1	0	1	-	S	F3
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	NO
Fpd	Evaporator fans during post-dripping 0 = on, 1 = off	0	0	1	-	0	NO

Variable-speed fans (EC fans)

On MPXzero Advanced (VCC frequency) only - version with two modulating outputs - it may be useful to connect variable speed fans so as to optimie energy consumption. In this case, the fans are powered by the mains, while the control signal may come via output Y1 or Y2, set as 0-10 Vdc.

Notice: function available only on: MPXzero VCC frequency version with analogue outputs (Y1, Y2).

The maximum and minimum fan speed can be set using advanced parameters F6 and F7.
If using the fan speed controller, F5 represents the temperature below which the fans are activated. There is a fixed hysteresis of 1°C for deactivation.

Code	Description	Def	Min	Max	UOM	User	User terminal
F5	Evaporator fan cut-off temperature (hysteresis 1°C)	50	F1	50	°C/°F	S	NO

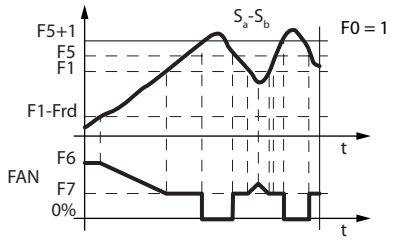


Fig. 5.x

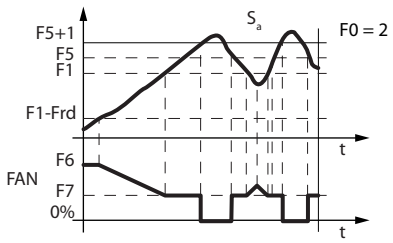


Fig. 5.y

Ref.	Description
Sa	Probe set by parameter FSa
Sb	Probe set by parameter FSb
F5	Fan cut-off temperature
F1	Fan deactivation threshold

Ref.	Description
Frd	Differential
t	time
FAN	Evaporator fans

The advanced parameters for the evaporator fans concern the minimum and maximum speed and the peak time.

Code	Description	Def	Min	Max	UOM	User	User terminal
F6	Maximum evaporator fan speed	100	F7	100	%	M	NO
F7	Minimum evaporator fan speed	0	0	F6	%	M	NO
F8	Evaporator fan peak time 0 = Function disabled	0	0	240	s	M	NO
F10	Evaporator fan forcing time at maximum speed 0 = Function disabled	0	0	240	min	M	NO

F6: is the maximum fan speed, expressed as a % of the output. For 0 to 10 V outputs, it represents the output voltage at maximum speed as a percentage. The same is true for the minimum speed set for F7.
The fan peak time F8 represents the operating time at maximum speed set using parameter F6 to overcome the mechanical inertia of the motor.
F10 represents the frequency at which the fan is operated at maximum speed for the peak time (F8). If the fan operates too long at low speed, ice may form on the blades; to avoid this, at intervals of every F10 minutes, the fan is switched on at maximum speed for the time set for parameter F8.

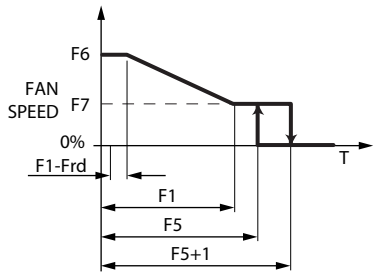


Fig. 5.z

Ref.	Description
T	temperature
F1	Fan activation threshold
Frd	Differential
F5	Fan cut-off temperature
F6	Maximum speed
F7	Minimum speed

5.5 Anti-sweat heater or fan modulation

The control of anti-sweat heaters is performed by comparing the dew point calculated based on the ambient temperature and humidity, and the temperature of the showcase glass, measured by a probe or estimated using the showcase outlet, intake and ambient temperature. Anti-sweat heaters can be controlled in two ways on the MPXzero Advanced (VCC frequency version with modulating outputs):

- PI (proportional, integral);
- fixed activation (manual control).

The conditions for the activation of the algorithms are as follows:

Algorithm	Activation condition
PI	rHd > 0
fixed activation (manual control)	rHd = 0; rHt >0

If the temperature read by the glass temperature probe is only estimated, PI control becomes proportional only. If both algorithms are activated, the PI algorithm has priority over fixed activation, which for activation does not require the ambient temperature and humidity probes. There are a series of conditions whereby the PI algorithm stops operating and, if enabled, fixed activation control takes over.

Condition	Cause
Glass temperature probe not valid	• physical probe not configured or faulty; • the estimated glass temperature probe value cannot be used as the outlet probe or intake probe is not configured or is faulty or the ambient probe is broken or absent (*)
Dew point not valid	• humidity probe and ambient temperature probe are both not configured or not working; • the serial dew point value is not available

Tab. 5.k

(*) If the intake probe is not configured or is faulty, only the outlet probe is used.

PI control

Inputs

The ambient humidity (SU) and temperature (SA) probe readings may be (see parameters /FL, /FI) sent from the supervisor via the serial probes.

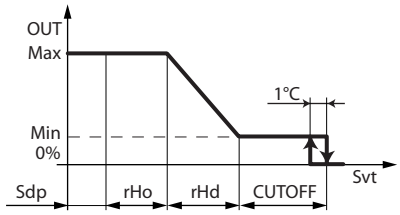
Alternatively, the supervisor can directly supply the dew point value (Sdp) using the serial probes (see parameter /Fn). The glass temperature probe (Svt) can be connected directly to each controller (see parameter /FM), or the value can be estimated. The estimate of the glass temperature probe reading is performed internally when: ambient temperature (SA), outlet temperature (Sm) and intake temperature (Sr) are available, and depends on parameters rHA, rHb and rHS. Parameters rHo, rHd and rHL determine the modulating output.

Code	Description	Def	Min	Max	UOM	User	User terminal
/Ac	Assign analogue output for variable speed fans - see /AA	0	0	2	-	M	NO
rHS	Virtual probe composition for glass temp. probe estimate 0 = Outlet probe Sm 100 = Intake probe Sr	20	0	100	%	S	NO
rHA	Coeff. A for glass temp. probe estimate	2	-20	20	°C/°F	S	NO
rHb	Coeff. B for glass temp. probe estimate	22	0	100	-	S	NO
rHo	Offset for anti-sweat modulation	2	-20	20	°C/°F	S	NO
rHd	Differential for anti-sweat heater modulation	0	0	20	°C/°F	S	NO

If one of the probes is not available (SA or either Sm or Sr), only fixed activation control will be possible, according to parameters rHu and rHt.

Outputs

The percentage of activation (OUT) for anti-sweat heater control depends on the difference between the dew point calculated and the value read by the glass temperature probe, the value of parameter rHo (offset) and the value of parameter rHd (differential), as shown in the following figure. The CUTOFF is a constant of 5°C and the hysteresis is 1°C.



Ref.	Description
SdP	Dew point
rHo	Offset for anti-sweat modulation
rHd	Diff. for anti-sweat heater modulation
OUT	Anti-sweat control
Svt	Glass temperature probe
Min	Minimum fan speed
Max	Maximum fan speed

Fig. 5.aa

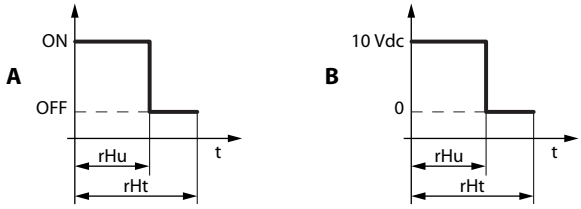
Min: fixed minimum output of 10%; Max: fixed maximum output of 100%.
The action is proportional only if the estimate of the glass temperature is used, and proportional and integral (Tint=240 s, constant) if the actual glass temperature probe is us. The aim of the integral action is to bring the glass temperature towards the set point (Sdp+rHo).

Important: if the serial probes from the supervisor are used for sending the ambient temperature and humidity values, MPXzero has four auxiliary variables that save the last useful value available for 30 minutes. This may be useful in the event where there is no communication with the supervisor.
When starting for the first time and these variables have not yet been initialised, it is normal for alarms to be shown temporarily relating to probes that have not been updated

Fixed activation control (manual control)

Control depends only on parameters rHu and rHt and follows the trend shown in the figure.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOQ	Assign anti-sweat heater digital output Val. Desc. / Val. Desc. 0 not configured / 3 digital output 3 (NO3) 1 digital output 1 (NO1) / 4 digital output 4 (NO4) 2 digital output 2 (NO2)	0	0	4	-	S	NO
rHu	Manual anti-sweat heater activation percentage (of period 'rHt') 0 = function disabled	70	0	100	%	S	NO
rHt	Manual anti-sweat heater activation period 0 = function disabled	5	0	180	min	S	NO



Ref.	Description
A	Relay output
B	0-10 Vdc output
rHu	Manual anti-sweat heater activation percentage
rHt	Manual anti-sweat heater activation period
t	Time

Notice: ON-OFF output on Y1 or Y2 (0-10 Vdc)

Fig. 5.ab

5.6 Compressor

MPXzero features the following compressor protection parameters.

Notice: The paragraph refers to applications with on-board compressor. Most of the functions apply similarly to the solenoid valve (refrigerant supply) in centralised applications.

Code	Description	Def	Min	Max	UOM	User	User terminal
d9	Defrost priority over compressor protection times 0/1 = protection times observed/protection times not observed	1	0	1	-	M	NO
c0	Delay to enable solenoid/compressor and evaporation fans at power-on	0	0	240	min	M	NO
c1	Min time between consecutive compressor starts	0	0	15	min	M	NO
c2	Min compressor OFF time	0	0	15	min	M	NO
c3	Min compressor ON time	0	0	15	min	M	NO

- c0 is used to delay the start of control when the device is powered on. This is useful in the event of power failures, so that the controllers (in the network) don't all start at the same time, avoiding potential problems of electrical overload. c1 sets the minimum time between two successive starts of the compressor, irrespective of the request. This parameter can be used to limit the maximum number of starts per hour;
- c2 sets the minimum compressor off time. The compressor will not be started again until the minimum time set has elapsed;
- c3 sets the minimum compressor running time;
- d9 disables the compressor protection times when defrosting:
  - d9 = 0: protection times are observed;
  - d9 = 1: protection times are ignored, defrosting has higher priority.

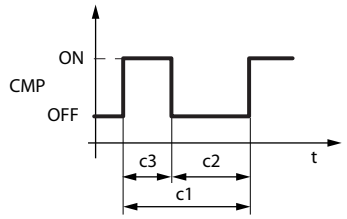


Fig. 5.ac

Ref.	Description
t	Time
CMP	Compressor

Compressor alarm management

A second ON-OFF compressor of the same size can be manage, configuring the corresponding digital output accordingly. Direct or reverse control can be set (see parameter rC).
Compressor 1 will always be the first to start and the last to stop. Compressor rotation is not available. The safety times for compressors 1 and 2 are calculated with reference to parameters c2, c3 and c4.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOK	Assign second ON/OFF compressor digital output - see DOA	0	0	4	-	S	NO
c11	Second compressor start delay	4			s	S	NO
c12	Second compressor start mode 0 = delay at start and in normal control 1 = delay sta start only	0	0	1	-	S	NO
rC	Operating mode 0/1 = Direct/Reverse	0	0	1	-	U	NO

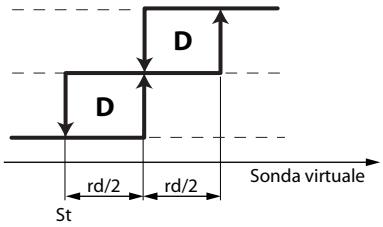


Fig. 5.ad

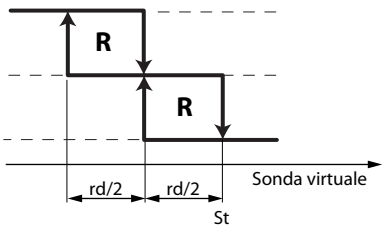


Fig. 5.ae

Unit periodic maintenance counter

The controller can signal when scheduled maintenance is required on the unit. This is done by configuring the number of operating hours and/or days after which (when the first or both elapse) a maintenance request is signalled by message "SrC" on the display. Once maintenance has been completed, the signal can be reset and the next maintenance can be programmed.

Code	Description	Def	Min	Max	UOM	User	User terminal
HMP	Unit operating hour threshold (in thousands)	0	0	45	hours	S	NO
HMr	Reset operating hours parameter and maintenance warning	0	0	1	-	S	NO
HMc	Threshold for number of days until next unit maintenance	-1	-1	3650	days	S	NO

5.7 Variable capacity compressor (VCC)

The MPXzero Advanced VCC controller calculates the optimum compressor speed based on the value read by the control probe, and sends this data to the VCC inverter, which then drives the compressor, based on the model, in one of two modes: frequency or serial protocol. In the serial protocol version, analogue outputs Y1 and Y2 are not available.

5.7.1 VCC with frequency control

To drive frequency-controlled inverters, the output signal is a digital square wave, with a voltage range from 0 to +10 Vdc, as described below. The duty cycle is 50%.

Par.	Description	Def	Min	Max	UOM	User	User terminal
/AG	Assign analogue output for modulating compressor 0 = not configured; 1 = analogue output 1 (Y1); 2 = analogue output 2 (Y2).	1	0	2	-	S	NO
/P5	Configuration of analogue output Y1: 0 = 0-10 V; 6 = PWM.	6	0	6	-	S	NO
/P6	Configuration of analogue output Y2: 0 = 0-10 V; 6 = PWM.	6	0	6	-	S	NO

The analogue output to be used, Y1 or Y2, is selected by parameter /AG, with the corresponding parameter /P5 or /P6 then set as a PWM output. The other analogue output remains available for a different function, where necessary.

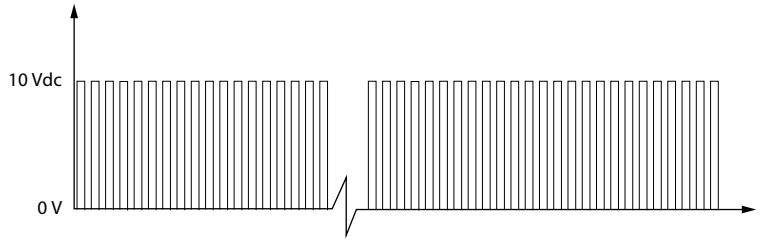


Fig. 5.af

The compressor speed follows the input frequency signal, with a relationship such as the one shown in the figure.

Notice: the reference frequencies and speeds vary according to the type of compressor and the parameter settings (see below).

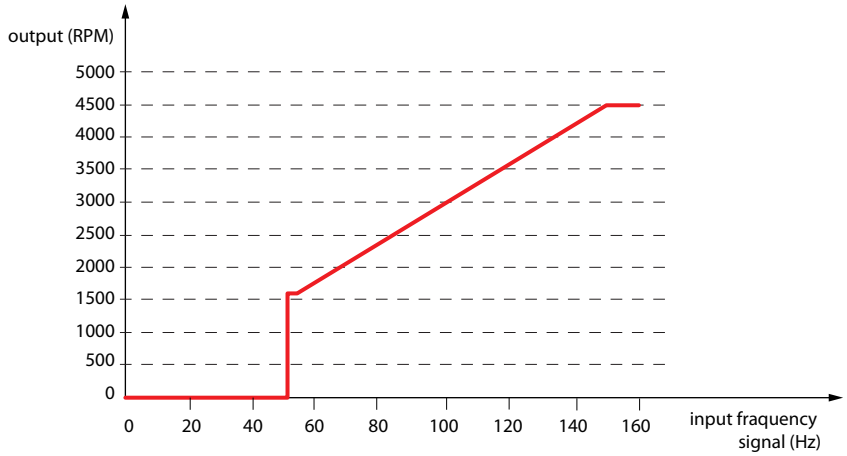


Fig. 5.ag

The following diagrams show two examples of connection to the Embraco and Secop inverters. It is recommended to refer to the inverter manufacturer's user manual for more detailed instructions and installation instructions.

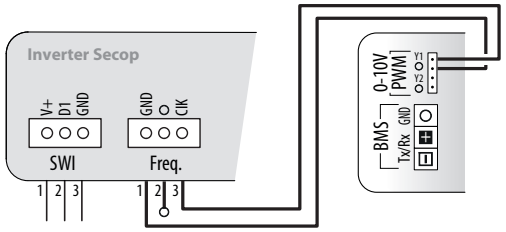


Fig. 5.ah

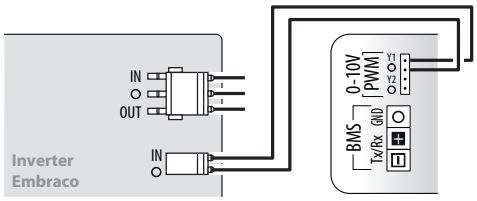


Fig. 5.ai

5.7.2 VCC with serial control

To drive inverters via serial, the connection is direct, as shown in the following table. The following diagrams show two examples of connection to the Embraco and Secop inverters. It is recommended to refer to the inverter manufacturer's user manual for more detailed instructions and installation instructions.

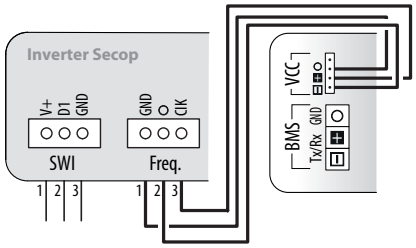


Fig. 5.aj

Serial connection terminal cross-reference

MPXzero Vcc	Secop	Embraco
+V	Not used	Not used
GND	GND	O
-	O	IN
+	CIK	OUT

Tab. 5.l

The serial communication protocol complies with the following technical specifications:

Asynchronous communication (start-stop)

Baud rate	600 baud
Start bits	1
Data bits	8
Stop bits	1
Parity	None
Flow control	None
Unit size	5 bytes

Tab. 5.m

The compressor speed is sent to the inverter via a specific serial protocol command. The compressor speed reflects the value sent.

Notice: the reference frequencies and speeds vary according to the type of compressor and the parameter settings.

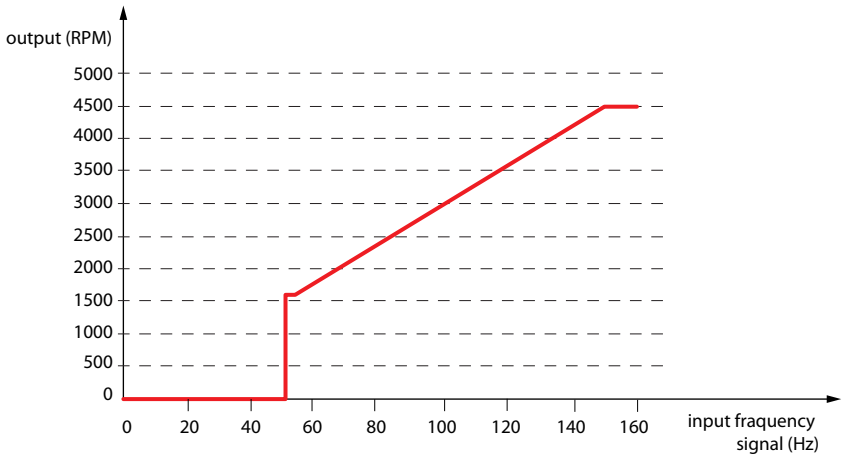


Fig. 5.ak

5.7.3 VCC compressor configuration

All of the VCC configuration parameters are expressed in units of frequency (Hz). The corresponding compressor rotation speed (rpm) depends on the relationship:

Compressor speed (rpm) = Frequency (Hz) * cuF

where cuF is the conversion factor between frequency and compressor speed.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cdf	VCC compressor frequency for hot gas defrost	140	0	255	Hz	M	NO
cMA	Maximum VCC compressor rotation frequency	150	0	250	Hz	M	NO
cMf	Maximum VCC compressor control frequency	100	0	255	Hz	M	NO
cMi	VCC compressor switch-off frequency	30	0	250	Hz	M	NO
cnf	Minimum VCC compressor control frequency	52	0	255	Hz	M	NO
cuF	Conversion factor from frequency (Hz) to compressor speed (rpm)	30	0	999	-	M	NO

Each VCC model works between two operating limit frequencies, the switch-off frequency and the maximum rotation frequency. The MPXzero controller uses the following preset values:
- cMi = switch-off frequency = 30 Hz (thermostat present signal, but VCC is off, 0 rpm)
- cMA = maximum rotation frequency = 150 Hz (4500 rpm)

For VCCs that use values other than those shown previously, see "Advanced VCC configuration".
To adapt the cooling capacity of the VCC to the actual needs of the application, set the following parameters:
- cnf = minimum control frequency; preset value = 52 Hz (1560 rpm);
- cMf = maximum control frequency; preset value = 100 Hz (3000 rpm).

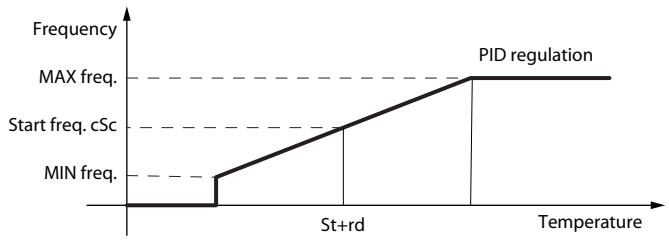
During normal control, when the conditions require the VCC to restart, the compressor runs at the soft-start frequency for the soft-start time (a few seconds). To adapt this frequency to the VCC oil recovery specifications, set the following parameters:
- cSc = soft-start frequency; preset value = 53 Hz (1590 rpm);
- cSt = soft-start time; preset value = 5 s.

When defrosting, if set in hot gas mode, the compressor runs at a fixed frequency, defined by the following parameter:
- cdf = hot gas defrost frequency; preset value = 140 Hz (4200 rpm).

5.7.4 VCC compressor control

The VCC compressor speed is controlled using a PID algorithm. The compressor remains off until the control temperature exceeds the value St + rd, at which point the compressor starts at the soft-start frequency cSc. After the soft-start time cSt, the PID algorithm manages the compressor speed within the operating range defined by cnF and cMF.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cct	VCC compressor off time	1	0	250	min	M	NO
cdt	PID control derivative term	1	0	255	s	M	NO
cPr	PID control proportional term	2	0	800	-	M	NO
ctl	PID control integral term	120	0	999	s	M	NO



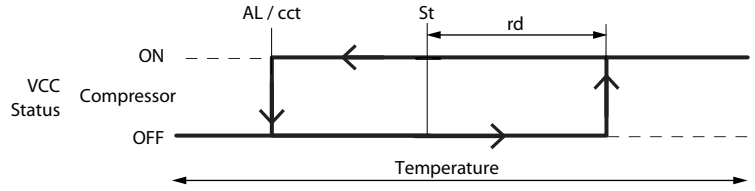
Ref.	Description
Sv	Control probe
St	Set point
rd	Control differential
cnf	Minimum control frequency
cSc	Soft start frequency
cMf	Maximum control frequency

Fig. 5.al

The PID control algorithm can be adapted to the needs of the application by setting the following parameters:
- cPr = PID control proportional term;
- ctl = PID control integral term;
- cdt = PID control derivative term.

The preset values are suitable and safe for starting any application the first time. When making adaptations, it is recommended to modify one parameter at a time and check the behaviour of the application in a controlled environment.
always heeding the limits declared by the manufacturer of the Vcc compressor.

If the compressor is on, the controller switches it off when the temperature read by the control probe Sv reaches the low temperature alarm threshold or the set point St for a time equal to cct:
- if cct is set to 0, the compressor stops immediately when Sv = St.
- if cct is set to 255, the compressor never stops.

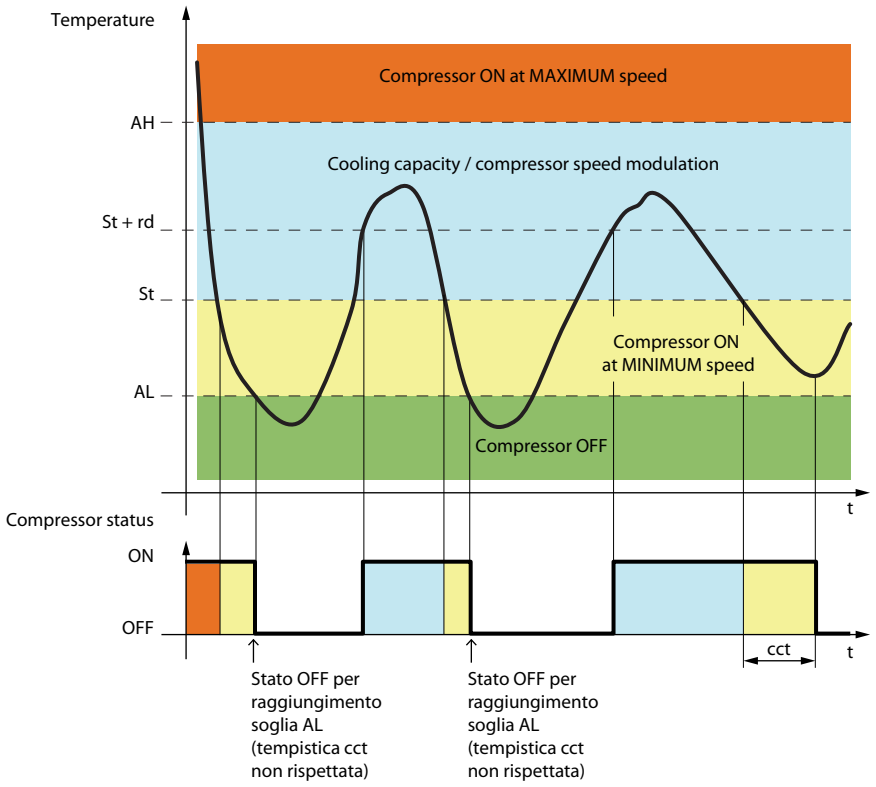


Ref.	Description
Sv	Control probe
St	Set point
rd	Control differential
AL / cct	Low temperature threshold or deactivation time reached

Fig. 5.am

To protect the refrigerated products, management of the two alarm thresholds has priority over normal control:
- AL = low temperature alarm threshold; when the temperature read by the control probe Sv is lower than the threshold AL, the controller immediately stops the compressor.
- AH = high temperature alarm threshold; when the temperature read by the control probe Sv is higher than the threshold AH, the controller activates the continuous cycle for the compressor (if cc> 0). See "Continuous cycle".

Par.	Description	Def.	Min	Max	UOM	User	User terminal
AH	High temperature alarm threshold	0	0	555/999	Δ °C/°F	U	YES
AHA	Absolute high temperature alarm threshold	537/999	-100 /-148	537/999	°C/°F	U	YES
AL	Low temperature alarm threshold	0	0	200/360	Δ °C/°F	U	YES
ALA	Absolute low temperature alarm threshold	-100/-148	-100 /-148	537/999	°C/°F	U	YES



Ref.	Description
St	Set point
rd	Control differential
AH	High temperature alarm threshold
AL	Low temperature alarm threshold

Fig. 5.an

5.7.5 Defrost with VCC compressor

When there is a hot gas defrost request, the variable speed compressor operates at the speed set by cdF. Activation of the defrost relay is delayed by the time dHA, while the drain heater is activated and remains on throughout the defrost, until the end of the post-heating phase dHE. The defrost relay is delayed by the drain heater activation time dHA. At the end of the defrost, the compressor switches back to normal control. The following diagram describes hot gas defrost with drain heater management.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cdf	VCC compressor frequency for hot gas defrost	140	0	255	hz	M	NO
ddF	VCC compressor frequency for dripping	140	cMi	255	hz	M	NO

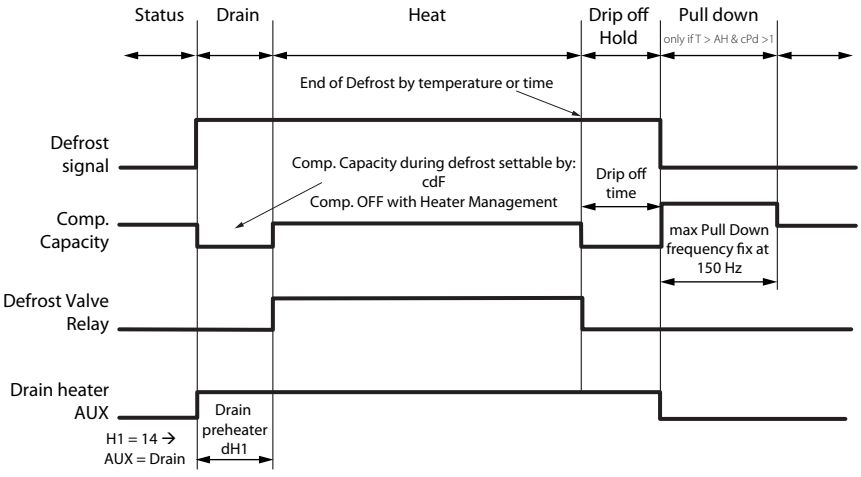


Fig. 5.ao

5.7.6 Continuous cycle with VCC compressor

When the continuous cycle is activated, the compressor is switched on (if off, otherwise it stays on). The compressor runs at the speed set by parameter cMA until the end of the continuous cycle (time set by cc or if ended in advance).

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cMA	Maximum VCC compressor rotation frequency	150	0	250	hz	M	NO

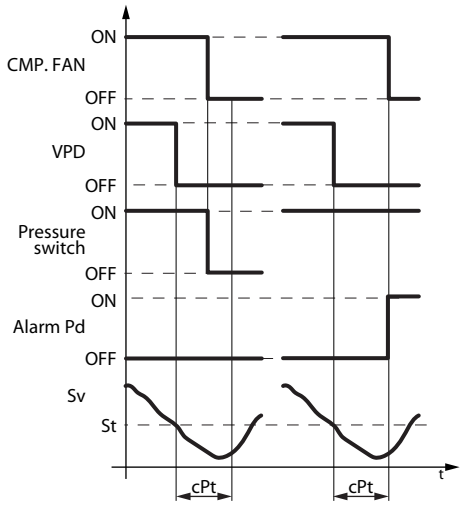
5.8 Pump down

When the compressor stops, the pump down procedure, if enabled, is performed to empty the evaporator. The pump down procedure can end by pressure or by time, as set by parameter c10.
If the procedure is managed based on pressure, a pressure switch needs to be connected to a digital input, par. DIt.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cPt	Maximum pump down time (0 = pump down disabled)	s	0	900	0	M	NO
c8	Compressor start delay after opening the pump down valve	s	0	60	5	M	NO
c10	Pump down by pressure or time: 0 = pressure; 1 = time.	0	1	1	-	M	NO
DIZ	Assign low pressure switch digital input: 0 = disabled; 1 = ID1; 2 = ID2	-	0	2	0	M	NO
DOn	Assign liquid valve digital output: 0 = disabled; 1 = NO1; 2 = NO2; 3 = NO3; 4 = NO4	-	0	4	0	M	NO

The pump down procedure is enabled if the liquid valve digital output is configured and parameter cPt > 0. When there is a request to stop the compressor, the liquid valve is closed until the low pressure switch is activated or the time cPt elapses, based on the setting of parameter c10.
If pump down is set to end by pressure and the pressure switch is not activated before the time cPt, the procedure is terminated when the time expires, and the Pump down ended after maximum time alarm Pd is generated.

Notice: for VCC compressors, during pump down the compressor is operated at the minimum frequency cnf.



Ref.	Description
St	Set point
rd	Control differential
Sv	Control threshold
PRESSURE SWITCH	Low pressure switch
CMP, FAN	Compressor request
VPD	Liquid valve output
ALARM Pd	Pump down ended after maximum time alarm
cPt	Pump down time

Fig. 5.ap

Notice: for VCC compressors, take care when setting parameter cct for stopping the compressor (Compressor cut-off time). To perform the pump down procedure, set cct = 0.

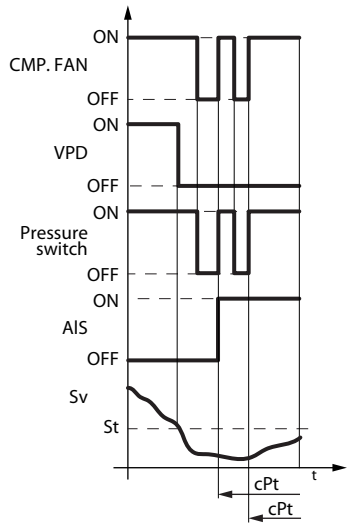


Fig. 5.aq

Ref.	Description
St	Set point
rd	Control differential
Sv	Control threshold
PRESSURE SWITCH	Low pressure switch
CMP, FAN	Compressor request
VPD	Liquid valve output
Ats	Restart in pump down alarm
cPt	Pump down time

When the compressor starts, the liquid valve is opened for the time set by parameter c8, to allow the pressure to equalise. If c8 = 0 pump down at power on is disabled.

5.8.1 Dead band and VCC compressor

If the reverse output is set for dead band control, the VCC compressor starts when St + rn/2 + rd, as described in "Dead band control". To activate the reverse output, the compressor must be off.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cct	VCC compressor off time	1	0	255	min	M	NO

Note the following:
- The compressor stops when the control temperature Sv < St and the time cct elapses.
- If cct is set to 0, the compressor stops immediately when the temperature reaches the set point St
- If cct is set to 255, the compressor never stops and the reverse output can never be activated.

5.8.2 On/Off compressor and VCC compressor

If the auxiliary compressor without rotation is configured, the first compressor to be activated is the VCC, as described in "VCC compressor control". The On/Off compressor will be activated second.

Par.	Description	Def	Min	Max	UOM	User	User terminal
c1	Min time between consecutive compressor starts	0	0	15	min	M	NO
c2	Min compressor OFF time	0	0	15	min	M	NO
c3	Min compressor ON time	0	0	15	min	M	NO

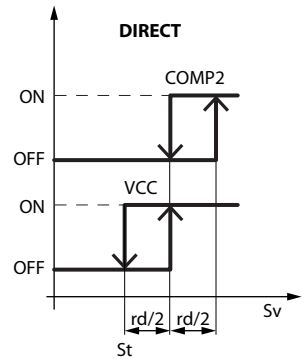


Fig. 5.ar

Ref.	Description
Sv	Control probe
St	Set point
rd	Control differential
VCC	VCC compressor request
COMP2	Auxiliary compressor request

The time set by parameter c11 is always observed between activation of the VCC compressor and activation of the On/Off compressor.

If the auxiliary compressor is configured as a parallel compressor, the auxiliary compressor is activated together with the VCC compressor, after the delay time c11.

5.8.3 High and low voltage protection (HLVP)

Some MPXzero models feature protection against high and low power supply voltages, allowing the compressor to operate only at voltages within the operating limits. This function stops the compressor if the mains voltage is outside of a range specified by parameters uHo and uLo. The compressor is switched off after a delay that can be set by parameter ucd. The compressor starts again when the voltage returns within the limits set by parameters uHI and uLI.

Par.	Description	Def	Min	Max	UOM	User	User terminal
c1	Minimum time between consecutive compressor starts	0	0	15	min	M	NO
c2	Minimum compressor OFF time	0	0	15	min	M	NO
c3	Minimum compressor ON time	0	0	15	min	M	NO
ucd	Compressor stop delay after HLVP protection activated	5	0	60	s	M	NO
udE	Enable display of HLVP protection alarms (EHI and ELO, see alarm table)	0	0	1	-	M	NO
uHi	High voltage protection start threshold	245	0	350	V	M	NO
uHo	High voltage protection end threshold	255	0	350	V	M	NO
uEn	Enable HLVP protection: 0 = disabled; 1 = enabled	0	0	1	-	M	NO
uLi	Low voltage protection start threshold	205	0	350	V	M	NO
uLo	Low voltage protection end threshold	195	0	350	V	M	NO

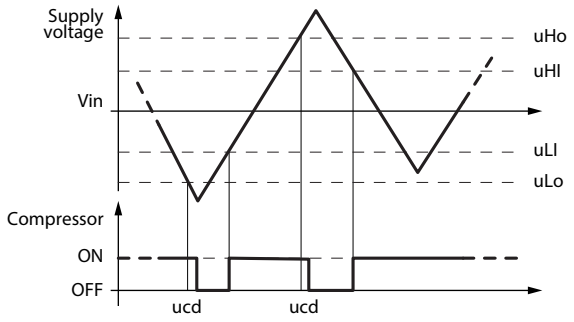


Fig. 5.as

Notice: the compressor protection times c1 and c3 are ignored when the high or low voltage conditions occur, while c2 is always observed.

Important:
- this function cannot be considered a compressor safety function;
- operation of the controller outside of the rated operating voltage range described in the technical specifications is the customer's responsibility.

5.9 Generic functions

MPXzero can exploit unused inputs and outputs to configure a "generic function". Each generic function can be enabled/disabled from the APPLICA app or SPARK program.

Important: the generic functions available vary according to the model of controller. The following can be activated (maximum configuration):
- 1 generic function with On/Off output;
- 1 generic function with modulating output (MPXzero Advanced VCC frequency model only);
- 1 generic alarm function (set as warning or serious alarm).

The generic function can be controlled based on:
- 1 specific probe, or
- difference between 2 suitably configured probes.

Important: the controller cannot verify the consistency of the settings, if two analogue functions are mistakenly assigned to the same analogue inputs or the same digital output.

5.9.1 Enabling

The generic function can be enabled always, or when the unit is in a certain status.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_E	Generic On/Off function: enable	0	0	10	-	S	NO
	0 Always; 1 Unit ON; 2 Unit OFF; 3 Defrost; 4 Clean; 5 Continuous cycle; 6 Duty setting; 7 Standby; 8 Control; 9 Door open; 10 Alarm active						
GFM_E	Generic modulating function: enable, see GFS_E	0	0	10	-	S	NO
GFA_E	Generic alarm function: enable, see GFS_E	0	0	10	-	S	NO

Assign control probe

Select the control probes for the generic function.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_1	Generic On/Off function: control probe 10 0 Not config. 1 Air off-outlet (Sm) 2 Defrost (Sd) 3 Air on-intake (Sr) 4 Auxiliary defrost (Sd2) 5 Auxiliary 1 (Saux1) 6 Auxiliary 2 (Saux2) 7 Ambient temp (SA) 8 Ambient humidity (SU) 9 Glass temperature (Svt) 10 Dew point (SdP) 11 Virtual probe (Sv)	0	0	11	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFS_1	0	0	11	-	S	NO
GFM_1	Generic modulating function: control probe 1- see GFS_1	0	0	11	-	S	NO
GFM_2	Generic modulating function: control probe 2- see GFS_1	0	0	11	-	S	NO
GFA_1	Generic alarm function: control probe 1 - see GFS_1	0	0	11	-	S	NO
GFA_2	Generic alarm function: control probe 2 - see GFS_1	0	0	11	-	S	NO

5.9.2 On/Off output

Assign the digital output for the generic function, the type (direct/reverse) and the activation logic (see parameter rOA).

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_T	Generic On/Off function: type 0 = Direct, 1 = Reverse	0	0	1	-	S	NO
GFS_S	Generic On/Off function: set point	0	-50	50	°C/°F	S	NO
GFS_D	Generic On/Off function: differential	0	0.0	99.9	°C/°F	S	NO
DOS	Generic On/Off function: digital output 0 = disabled 1 = NO1 2 = NO2 3 = NO3 4 = NO4	0	0	4	-	S	NO
rOS	Generic On/Off function: logic 0 = Direct, 1 = Reverse	0	0	1	-	S	NO

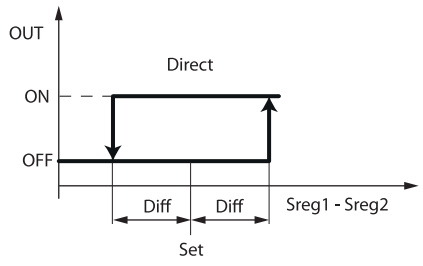


Fig. 5.at

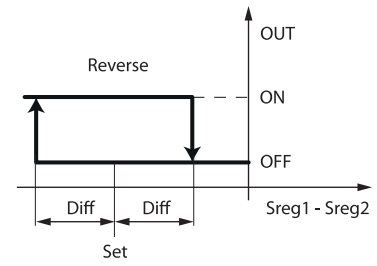


Fig. 5.au

Ref.	Description
Set	Set point
Diff	Differential
Sreg1 - Sreg2	Control probe 1 Control probe 2
OUT	Digital output

5.9.3 Modulating output (Advanced VCC frequency only)

Assign the modulating output for the generic function and the type (direct/reverse). It is possible to use proportional control only or PID, as well as a cut-off differential with hysteresis.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFM_T	Generic modulating function: type 0 = Direct, 1 = Reverse	0	0	1	-	S	NO
GFM_S	Generic modulating function: set point	0	-50	50	°C/°F	S	NO
GFM_D	Generic modulating function: differential	0	0	99.9	°C/°F	S	NO
GFM_Kp	Generic modulating function: proportional gain	0	0	100	-	S	NO
GFM_Td	Generic modulating function: derivative time	0	0	100	-	S	NO
GFM_Ti	Generic modulating function: integral time	0	0	900	-	S	NO
GFM_CD	Generic modulating function: cut-off differential	0	0	20	-	S	NO
GFM_H	Generic modulating function: hysteresis	0	0	20	-	S	NO
GFM_Max	Generic modulating function: max output value	0	0	100	-	S	NO
GFM_Min	Generic modulating function: min output value	0	0	100	-	S	NO
/Ad	Generic modulating function: analogue output 0 = disabled 1 = Y1 2 = Y2	0	0	2	-	S	NO

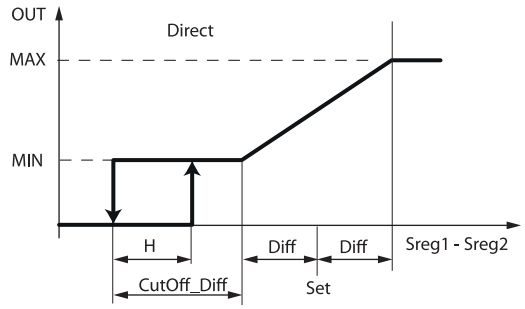


Fig. 5.av

Ref.	Description
Set	Set point
Diff	Differential
H	Hysteresis
Sreg1 - Sreg2	Control probe1 - Control probe 2
OUT	Digital output
CutOff_Diff	Cut-off differential

5.9.4 Alarm signal

The alarm can be activated for two reasons:

1. switching of the digital input, assigned by parameter DIs: the display shows "GHI"
2. if the difference between the values of the control probes exceeds the high or low threshold: the display shows GHI or GLO respectively.

Notice: the generic alarm can be configured as a warning or a serious alarm by setting parameter GFA_AlType.

The generic alarm function reset can be configured as: automatic (default), semi-automatic or manual.
For semi-automatic reset, it is possible to set the number of occurrences of the alarm and corresponding time interval before requiring manual reset directly on the display, via supervisor or APPLICA.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIs	Assign digital input for generic alarm function 0 = Function disabled; 2 = digital input 2 (ID2) 1 = digital input 1 (ID1); - 1 = serial digital input	0	-1	2	-	S	NO
GFA_AlType	Generic alarm function: type 0 = Warning, 1 = Serious	0	0	1	-	S	NO
GFA_AA	Generic alarm function: action performed when the alarm is generated 0 = no action; 2 = reduce control capacity 1 = stop control; 3 = switch off lights	0	0	3	-	S	NO
GFA_r	Generic alarm function: reset type 0 = automatic; 2 = manual; 3 = semi-automatic	0	0	2	-	S	NO
GFA_n	Generic alarm function: number of occurrences for semi-automatic alarm reset	0	0	99	-	S	NO
GFA_P	Generic alarm function: time period to monitor semi-automatic alarm reset	0	0	999	min	S	NO
GFA_De	General alarm function: delay	0	0	254	-	S	NO
GFA_D	Generic alarm function: differential	0	0	99.9	-	S	NO
GFA_Hth	Generic alarm function: high temperature threshold	0	-50	50	-	S	NO
GFA_Lth	General alarm function: low temperature threshold	0	-50	50	-	S	NO

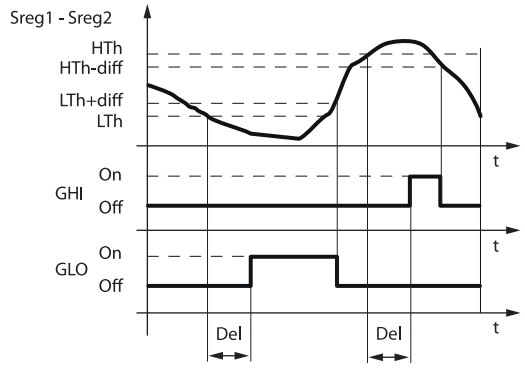


Fig. 5.aw

Ref.	Description
Lth	Low temperature threshold
HTh	High temperature threshold
diff	Differential
Del	Delay
t	Time
Sreg1 - Sreg2	Control probe1 - Control probe 2
GHI	High temperature alarm message
GLO	Low temperature alarm message

Example

Display of the generic alarm when exceeding the thresholds.

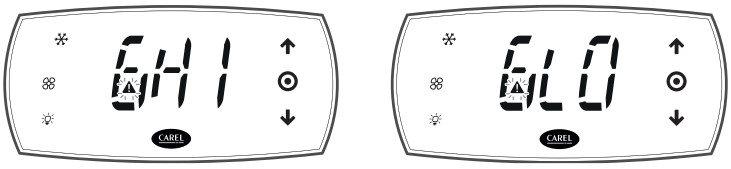


Fig. 5.ax

Generic warning function (prevent)

Before the generic alarm function is activated, a warning signal with automatic reset can also be enabled. Parameters GFA_1 and GFA_2 define the activation conditions for both functions.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFA_We	Generic alarm function: enable warning 0= not active, 1 = active	0	0	1	-	S	NO
GFA_WA	Generic alarm function: action to be performed when warning activated 0 = no action 1 = stop control 2 = reduce control capacity 3 = switch off lights	0	0	3	-	S	NO
GFA_WDe	Generic alarm function: warning activation delay	0	0	30000	s	S	NO
GFA_WD	Generic alarm function: warning reset differential	0	0	99.9	-	S	NO
GFA_WHth	General alarm function: high warning threshold	0	-50	200	-	S	NO
GFA_WLth	General alarm function: low warning threshold	0	-50	200	-	S	NO

6. PARAMETER TABLE

Below is the table of the parameters that can be displayed on the terminal or can be modified using the commissioning software or APPLICA app.

The APPLICA app and commissioning tools for MPXzero have three predefined parameter access levels: User (U), Service (S) and Manufacturer (M).
The default passwords to access the Service and Manufacturer parameters from the APPLICA app for MPXzero are 22 and 44 respectively. The Manufacturer level password also allows access to the Service parameters, and the level S password also allows access to the User parameters. The password for navigating the menu from the display, on the other hand, is 33.

Code	Description	Def	Min	Max	UOM	User	User terminal
PDM	Manufacturer password	44	-	-	-	M	NO
PDS	Service password	22	-	-	-	M	NO
PDU	User password	-	-	-	-	S	NO

Notice:
- the read-only parameters are not visible from the Applica app using NFC, as NFC memory cannot be overwritten frequently;
- to avoid any fraudulent activities, the default password values should be changed at the end of the commissioning procedure. For example, with the APPLICA app, parameters PDM, PDS and PDU can be used to set new passwords, with a maximum length of 8 characters, both alphanumeric and special.

Important: the operation to reset the default values is not reversible, unless a user configuration has been previously saved for loading using the commissioning software/Applica app, see the paragraph on configurations.

6.1 System

Code	Description	Def	Min	Max	UOM	User	User terminal
/P1	Type of probe, group 1 (S1, S2, S3) 0 = PT1000 Standard Range –50T150 °C 1 = NTC Standard Range –50T90°C	1	0	1	-	S	YES
/P5	Configuration of analogue output Y1: 0 = 0-10 V; 6 = PWM.	6	0	6	-	S	NO
/P6	Configuration of analogue output Y2: 0 = 0-10 V; 6 = PWM.	6	0	6	-	S	NO
/FA	0 Function disabled; 1 Probe S1; 2 Probe S2; 3 Probe S3; -1 Serial probe S11; -2 Serial probe S12; -3 Serial probe S13; -4 Serial probe S14	1	-4	3	-	S	YES
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	3	-	S	YES
/Fc	Assign intake temperature probe (Sr) - see /FA	3	-4	3	-	S	YES
/FF	Assign defrost temperature probe 2 (Sd2) - see /FA	0	-4	3	-	S	NO
/FG	Assign auxiliary temperature/pressure probe 1 (Saux1) - see /FA	0	-4	3	-	S	NO
/FH	Assign auxiliary temperature/pressure probe 2 (Saux2) - see /FA	0	-4	3	-	S	NO
/FI	Assign ambient temperature probe (SA) - see /FA	0	-4	3	-	S	NO
/FL	Assign ambient humidity probe (SU) - see /FA	0	-4	3	-	S	NO
/FM	Assign glass temperature probe (Svt) - see /FA	0	-4	3	-	S	NO
/Fn	Assign dewpoint value (SdP) - see /FA	0	-4	3	-	S	NO
/cA	Outlet temperature probe (Sm) calibration	0	-20	20	°C/°F	S	NO
/cb	Defrost temperature probe (Sd) calibration	0	-20	20	°C/°F	S	NO
/cc	Intake temperature probe (Sr) calibration	0	-20	20	°C/°F	S	NO
/cF	Defrost temperature probe 2 (Sd2) calibration	0	-20	20	°C/°F	S	NO
/cG	Auxiliary temperature/pressure probe 1 (Saux1) calibration	0	-20	20	-	M	NO
/cH	Auxiliary temperature/pressure probe 2 (Saux2) calibration	0	-20	20	-	M	NO
/cI	Ambient temperature probe (SA) calibration	0	-20	20	°C/°F	S	NO
/cL	Ambient humidity probe (SU) calibration	0	-20	20	°C/°F	S	NO
/cM	Glass temperature probe (Svt) calibration	0	-20	20	°C/°F	S	NO
/cn	Dewpoint value (SdP) calibration	0	-20	20	°C/°F	S	NO
/co	Condenser temperature probe calibration	0	-20	20	°C/°F	S	NO
/2	Analogue probe measurement stability	9	1	15	-	M	NO

Tab. 6.a

Code	Description	Def	Min	Max	UOM	User	User terminal
Digital inputs							
DIA	Assign digital input for immediate external alarm 0 Function disabled 1 Digital input 1 (ID1) 2 Digital input 2 (ID2)	0	-1	2	-	S	NO
DIs	Assign digital input for generic alarm function 1 Function disabled 2 digital input 1 (ID1) 3 digital input 2 (ID2) -1 serial digital input	0	-1	2	-	S	NO
DIb	Assign delayed external alarm digital input - see DIA	0	-1	2	-	S	NO
DIc	Assign enable defrost digital input - see DIA	0	-1	2	-	S	NO
DId	Assign start defrost digital input - see DIA	0	-1	2	-	S	NO
DIE	Assign digital input for door switch with solenoid/compressor and evaporator fans OFF - see DIA	0	-1	2	-	S	NO
DIF	Assign remote ON/OFF digital input - see DIA	0	-1	2	-	S	NO
DIG	Assign curtain switch digital input - see DIA	0	-1	2	-	S	NO
DIH	Assign start/stop continuous cycle digital input - see DIA	0	-1	2	-	S	NO
DIL	Assign timed digital input - see DIA	0	-1	2	-	S	NO
DIM	Assign digital input for switching to standby mode - see DIA	0	-1	2	-	S	NO
DIn	Assign digital input for switching to clean mode - see DIA	0	-1	2	-	S	NO
DIo	Assign working parameter set change digital input - see DIA	0	-1	2	-	S	NO
DIP	Assign door switch without control stop digital input - see DIA	0	-1	2	-	S	NO
DIr	Assign defrost according to DI status digital input - see DIA	0	-1	2	-	S	NO
DIZ	Assign low pressure switch digital input - see DIA	0	-1	2	-	S	NO
rIA	Immediate alarm digital input logic 0 = direct logic 1 = reverse logic	0	0	1	-	S	NO
rIb	Delayed external alarm digital input logic - see rIA	0	0	1	-	S	NO
rIc	Enable defrost digital input logic - see rIA	0	0	1	-	S	NO
rId	Start defrost digital input logic - see rIA	0	0	1	-	S	NO
rIE	Door with solenoid/compressor and evaporator fans OFF digital input logic - see rIA	0	0	1	-	S	NO
rIF	Remote ON/OFF digital input logic - see rIA	0	0	1	-	S	NO
rIG	Curtain switch digital input logic - see rIA	0	0	1	-	S	NO
Rih	Start/stop continuous cycle digital input logic - see rIA	0	0	1	-	S	NO
rIL	Timed digital input logic - see rIA	0	0	1	-	S	NO
rIM	Standby mode switch digital input logic - see rIA	0	0	1	-	S	NO
rIn	Clean mode switch digital input logic - see rIA	0	0	1	-	S	NO
rIo	Change working parameter configuration digital input logic - see rIA	0	0	1	-	S	NO
rIZ	Low pressure switch digital input logic - see rIA	0	0	1	-	S	NO
rIP	Door switch without control stop digital input - see rIA	0	0	1	-	S	NO
rIr	Defrost according to DI status digital input logic - see rIA	0	0	1	-	S	NO
rIs	Generic function alarm digital input logic - see rIA	0	0	1	-	S	NO
A9	Select digital input broadcast from Main to Secondary (only on Main) -1 from the supervisor 0 disabled 1 digital input 1 (ID1) 2 digital input 2 (ID2)	0	-1	2	-	S	NO
dIt	Timer duration (timed input) 0 = function disabled	0	0	999	min	S	NO
Digital outputs							
DOA	Assogn solenoid/compressor digital output 0 not configured 1 digital input 1 (ID1) 2 digital input 2 (ID2) 3 digital input 3 (ID3) 4 digital input 4 (ID4)	2	0	4	-	S	NO
DOb	Assign alarm digital output - see DOA	0	0	4	-	S	NO
DOc	Assign auxiliary digital output - see DOA	0	0	4	-	S	NO
DOd	Assign auxiliary digital output serving the Main on the Secondary devices - see DOA	0	0	4	-	S	NO
DOE	Assign light digital output - see DOA	4	0	4	-	S	NO
DOF	Assign light digital output serving the Main on the Secondary devices - see DOA	0	0	4	-	S	NO
DOG	Assign defrost digital output - see DOA	1	0	4	-	S	NO
DOH	Assign auxiliary evaporator defrost digital output - see DOA	0	0	4	-	S	NO
DOK	Assign second ON/OFF compressor digital output - see DOA	0	0	4	-	S	NO
DOI	Assign evaporator fan digital output - see DOA	3	0	4	-	M	NO
DOn	Assign digital output for liquid valve (pump down)	0	0	4	-	S	NO
DOo	Assign timed digital output - see DOA	0	0	4	-	M	NO
DOP	Assign drain heater digital output - see DOA	0	0	4	-	M	NO
DOQ	Assign anti-sweat heater digital output - see DOA	0	0	4	-	S	NO
DOAA	Assign hot gas defrost digital output - see DOA	0	0	4	-	M	NO
DOt	Assign digital output for max fan speed connection	0	0	4	-	M	NO
DOu	Assign digital output for min fan speed connection	0	0	4	-	M	NO
rOA	Solenoid/compressor digital output logic 0 = direct, 1 = reverse	0	0	1	-	M	NO
rOb	Alarm digital output logic - see rOA	0	0	1	-	M	NO
rOc	Auxiliary digital output logic - see rOA	0	0	1	-	M	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
rOd	Auxiliary serving the Main on the Secondary devices digital output logic - see rOA	0	0	1	-	M	NO
rOE	Light digital output logic - see rOA	0	0	1	-	S	NO
rOF	Light serving the Main on the Secondary devices digital output logic - see rOA	0	0	1	-	S	NO
rOG	Defrost digital output logic - see rOA	0	0	1	-	S	NO
rOH	Auxiliary evaporator defrost digital output logic - see rOA	0	0	1	-	S	NO
rOI	Evaporator fan digital output logic - see rOA	0	0	1	-	S	NO
rOn	Liquid valve digital output logic - see rOA	0	0	1	-	M	NO
rOP	Drain heater digital output logic - see rOA	0	0	1	-	M	NO
rOQ	Anti-sweat heater digital output logic - see rOA	0	0	1	-	M	NO
rOAA	Hot gas defrost digital output logic - see rOA	0	0	1	-	M	NO
rOt	Maximum fan speed connection digital output logic - see rOA	0	0	1	-	M	NO
rOu	Minimum fan speed connection digital output logic - see rOA	0	0	1	-	M	NO
H9	Output switched with time bands 0 = Light 1 = AUX	0	0	1	-	S	NO
Analogue outputs (MPXzero Advanced versions with modulating outputs only)							
/AA	Assign analogue output for modulating evaporator modulating 0 = not configured 1 = analogue output 1 (Y1) 2 = analogue output 2 (Y2)	0	0	2	-	M	NO
/Ac	Assign analogue output for modulating anti-sweat heaters - see /AA	0	0	2	-	M	NO
/Ad	Assign analogue output for generic modulating function - see /AA	0	0	2	-	M	NO
/AE	Assign analogue output for condenser fans (Advanced VCC frequency model only) - see /AA	0	0	2	-	M	NO
/AF	Assign analogue output for LED lights (Advanced VCC frequency model only) - see /AA	0	0	2	-	M	NO
/AG	Assign analogue output for VCC compressor (Advanced VCC frequency model only) - see /AA	0	0	2	-	M	NO
Control							
ON	ON/OFF command 0 = OFF, 1 = ON	0	0	1	-	S	YES
/4	Virtual probe composition 0 = Outlet probe Sm 100 = Intake probe Sr	0	0	100	%	S	NO
r1	Minimum set point	-50	-50	r2	°C/°F	M	NO
r2	Maximum set point	50	r1	200	°C/°F	M	NO
r4	Automatic night set point variation	0	-50	50	°C/°F	S	NO
r6	Probe for night-time control 0 = virtual probe Sv, 1 = intake probe Sr	0	0	1	-	S	NO
ro	Control offset with probe error	0	0	20	°C/°F	S	NO
r7	Main solenoid valve configuration 0 = local valve, 1 = network valve (connected to Main)	0	0	1	-	S	YES
St	Set point	50	r1	r2	°C/°F	U	YES
St2	Intake probe set point with double thermostat	50	r1	r2	°C/°F	S	NO
rd	Differential	2	0.1	99.9	°C/°F	U	YES
rC	Operating mode 0 = Direct, 1 = Reverse	0	0	1	-	U	NO
rd2	Set point St2 differential with double thermostat 0.0 = function disabled	0	0	99.9	°C/°F	S	NO
rHS	Virtual probe composition for glass temp. probe estimate 0 = Outlet probe Sm 100 = Intake probe Sr	20	0	100	%	S	NO
rHA	Coeff. A for glass temp. probe estimate	2	-20	20	°C/°F	S	NO
rHb	Coeff. B for glass temp. probe estimate	22	0	100	-	S	NO
rHo	Offset for anti-sweat modulation	2	-20	20	°C/°F	S	NO
rHd	Differential for anti-sweat heater modulation	0	0	20	°C/°F	S	NO
rHu	Manual anti-sweat heater activation percentage (of period 'rHt') 0 = function disabled	70	0	100	%	S	NO
rHt	Manual anti-sweat heater activation period 0 = function disabled	5	0	180	min	S	NO
CLt	Max time for clean status	0	0	999	min	U	NO
Stt	Maximum time for standby status	0	0	240	min	S	NO
H14	Time light stays on after closing the door	0	0	240	min	U	NO
dbS	Safety timeout for double thermostat function	0	0	240	min	M	NO
db1	Double thermostat function logic 0 = logical AND, 1 = logical OR	0	0	1	-	M	NO
Pump down							
C8	Compressor start delay after opening the pump down valve	5	0	60	s	S	YES
C10	End pump down mode (time or pressure) 0 = time mode, 1 = pressure mode	0	0	1	-	S	NO
cPt	Maximum pump down time 0 = mode disabled	30	0	900	s	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
Defrost							
d0	Type of defrost 0 heater by temperature 1 hot gas by temperature 2 heater by time 3 hot gas by time 4 temperature control with heater by time	0	0	4	-	S	YES
dEP	Assign probe for end defrost in advance 0 Not configured 1 Outlet (Sm) 2 Defrost (Sd) 3 Intake (Sr) 4 Defrost 2 (Sd2) 5 Auxiliary 1 (Saux1) 6 Auxiliary 2 (Saux2) 7 Ambient (SA) 8 Ambient humidity (SU) 9 Glass temperature (Svt) 10 Dew point (SdP) 11 Virtual probe (Sv)	0	0	11	-	S	NO
dET	Temperature threshold for end defrost in advance	50	99.9	99.9	°C	S	NO
d2	End defrost synchronised by Main 0 = not synchronised, 1 = synchronised	1	0	1	-	S	NO
d3	Send start network defrost signal (for Main) 0 = yes, 1 = no Ignore start network defrost signal (for Secondary) 0 = no, 1 = yes	0	0	1	-	S	NO
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	YES
dt1	End defrost temperature (read by Sd)	8	-50	50	°C/°F	S	YES
dt2	End defrost temperature (read by Sd2)	8	-50	50	°C/°F	S	NO
dP1	Maximum defrost duration	45	1	240	min	S	YES
dP2	Max Secondary evaporator defrost duration	45	1	240	min	S	NO
d4	Defrost at power on (Main = network defrost; Secondary = local defrost) 0 = No, 1 = Yes	0	0	1	-	S	NO
d5	Defrost delay at power-on or (for Secondary) after control signal from Main 0 = delay disabled	0	0	240	min	S	NO
d6	Display on terminals during defrost 0 = temperature alternating with 'dEF' 1 = freeze display 2 = 'dEF'	1	0	2	-	U	NO
dd	Dripping time after defrost (fans off) 0 = no dripping	2	0	15	min	S	NO
d7	Skip defrost 0 = disabled, 1 = enabled	0	0	1	-	S	NO
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	NO
d9	Defrost priority over compressor protection times 0 = compressor protection times observed, 1 = compressor protection times ignored	1	0	1	-	M	NO
d10	Defrost time in running time mode 0 = function disabled	0	0	240	min	S	NO
d11	Defrost temperature threshold in running time mode	-30	-50	50	°C/°F	S	NO
dH1	Pump down duration 0 = pump down disabled	0	0	999	s	M	NO
dS1	Compressor off time in sequential stop defrost mode 0 = function disabled	0	0	45	min	M	NO
dS2	Compressor operating time in sequential stop defrost mode	120	0	240	min	M	NO
ddt	Additional end defrost temperature delta in power defrost mode	0	-20	20	°C/°F	S	NO
ddP	Additional maximum defrost time delta in power defrost mode	0	0	60	min	S	NO
dn	Nominal defrost duration for skip defrost	75	0	100	%	S	NO
r3	End defrost by timeout signal 0 = disabled, 1 = enabled	0	0	1	-	S	NO
c7	Defrost priority over continuous cycle 0 = No, 1 = Yes	0	0	1	-	M	NO
dd1	Assign probe 1 to determine start defrost (dd1-dd2) - see FSa	0	0	14	-	S	NO
dd2	Assign probe 2 to determine start defrost (dd1-dd2) - see FSa	0	0	14	-	S	NO
dTd	Temperature differential threshold to start defrost	50	99.9	99.9	°C	S	NO
tdd	Threshold evaluation time to start defrost	60	15	240	min	S	NO
cdF	Compressor frequency during hot gas defrost procedure	140	0	255	Hz	S	NO
ddf	Compressor frequency during dripping phase after hot gas defrost	140	0	255	Hz	S	NO
dHG	Hot gas activation delay	0	0	300	s	S	NO
Defrost scheduling							
td1..8-d	Defrost 1 to 8 - day 0 = event disabled 1 to 7 = Monday to Sunday 8 = Monday to Friday 9 = from Monday to Saturday 10 = Saturday & Sunday 11 = every day	0	0	11	day	S	NO
td1..8-hh	Defrost 1 to 8 - hours	0	0	23	hours	S	NO
td1..8-mm	Defrost 1 to 8 - minutes	0	0	59	minutes	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal, 1 = power defrost	0	0	1	-	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
d1S	Number of daily defrosts (td1) 0 = Disabled; 5 = 4 hours and 48 minutes; 10 = 2 hours and 24 minutes 1 = 24 hours and 0 minutes; 6 = 4 hours and 0 minutes; 11 = 2 hours and 11 minutes 2 = 12 hours and 0 minutes; 7 = 3 hours and 26 minutes; 12 = 2 hours and 0 minutes 3 = 8 hours and 0 minutes; 8 = 3 hours and 0 minutes; 13 = 1 hour and 0 minutes 4 = 6 hours and 0 minutes; 9 = 2 hours and 40 minutes; 14 = 30 minutes	0	0	14	-	S	NO
d2S	Number of daily defrosts (td2) - see d1S	0	0	14	-	S	NO
Evaporator fans							
F0	Evaporator fan management 0 = always on 1 = activation based on Sa - Sb (see FSa and FSb) 2 = activation based on Sa (Sa = first probe, Sb = second probe)	0	0	2	-	S	YES
F1	Evaporator fan activation threshold (only if F0 = 1 or 2)	-5	-50	50	°C/°F	S	YES
F2	Evaporator fans with compressor off 0 = see F0 1 = always off	1	0	1	-	S	YES
F3	Evaporator fans during defrost 0 = on, 1 = off	1	0	1	-	S	F3
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	NO
Frd	Fan activation differential (including variable speed)	2	0.1	20	°C/°F	S	YES
F5	Evaporator fan cut-off temperature (hysteresis 1°C)	50	F1	50	°C/°F	S	NO
F6	Maximum evaporator fan speed	100	F7	100	%	M	NO
F7	Minimum evaporator fan speed	0	0	F6	%	M	NO
F8	Evaporator fan peak time 0 = Function disabled	0	0	240	s	M	NO
F10	Evaporator fan forcing time at maximum speed 0 = Function disabled	0	0	240	min	M	NO
FSa	First fan control probe 0 Not configured; 1 Outlet (Sm); 2 Defrost (Sd); 3 Intake (Sr); 4 Defrost 2 (Sd2); 5 Auxiliary 1 (Saux1); 6 Auxiliary 2 (Saux2); 7 Ambient (SA); 8 Ambient humidity (SU); 9 Glass temperature (Svt); 10 Dew point (SdP); 11 Virtual probe (Sv)	2	0	11	-	M	NO
FSb	Second fan control probe - see FSa	11	0	11	-	M	NO
Fpd	Evaporator fans during post-dripping 0 = On, 1 = Off	0	0	1	-	0	NO
POM	Unit cooling capacity indication	4000	0	32000	watts	M	NO
Condenser fans							
F00	Condenser fan management: 0 = follows compressor ON-OFF 1 = modulating	0	0	1	-	S	YES
F4	Condenser fan deactivation temperature	40	-50	200	°C	S	YES
F5d	Condenser fan activation differential	5	0.1	60	°C	S	NO
/Fo	Assign condenser temperature probe (Sc) 0 Function disabled; 1 S1; 2 S2; 4 S3; -1 S11 (serial probe); -2 S12 (serial probe); -3 S13 (serial probe); -4 S14 (serial probe)	0	-4	3	-	S	NO
FCC	Condenser fan cut-off threshold	2	0	50	°C	S	NO
FCH	Maximum modulating condenser fan speed	100	0	100	%	S	NO
FCL	Minimum modulating condenser fan speed	0	0	100	%	S	NO
Ac	Temperature threshold for condenser cleaning alarm	70	0	250	°C	S	YES
AE	Differential threshold for resetting condenser cleaning alarm	5	0.1	20	°C	S	YES
Acd	Condenser cleaning alarm signal delay	0	0	240	min	S	YES
Solenoid/compressor							
c0	Delay to enable solenoid/compressor and evaporation fans at power-on	0	0	240	min	M	NO
c1	Minimum time between consecutive compressor starts	0	0	15	min	M	NO
c2	Minimum compressor OFF time	0	0	15	min	M	NO
c3	Minimum compressor ON time	0	0	15	min	M	NO
c4	ON time for duty setting operation (Toff = 15 minutes, fixed value) 0 = compressor/valve always OFF 100 = compressor/valve always ON	0	0	100	min	M	NO
cc	Running time in continuous cycle 0 = Disabled	0	0	15	hours	M	NO
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	NO
c11	Second compressor start delay	4	0	250	s	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
c12	Second compressor start mode 0 = delay at start and in normal control 1 = delay sta start only	0	0	1	-	S	NO
Variable speed compressor (VCC)							
cMi	Compressor switch-off frequency	30	0	255	Hz	S	YES
cMA	Nominal compressor rotation frequency	150	0	255	Hz	S	YES
Cnf	Minimum compressor rotation frequency during control	52	0	255	Hz	S	YES
CMf	Maximum compressor rotation frequency during control	100	0	255	Hz	S	YES
cSc	Compressor activation frequency	53	0	255	Hz	S	YES
cSt	Compressor start time at frequency cSc	5	0	240	s	S	NO
cPr	PID: proportional control coefficient	2	0	800	-	S	NO
ctI	PID: integral time control coefficient	120	0	999	s	S	NO
cdt	PID: derivative time control coefficient	1	0	255	s	S	NO
cct	Compressor cut-off time cct=255 always on	1	0	255	min	S	YES
cuF	Conversion factor from Hz to rpm	30	0	99.9	-	M	NO
Ctd	Inverter communication alarm signal delay Ctd = 0 COM alarm disabled	15	0	60	s	M	NO
CoA	Enable UCF alarm	1	0	1	-	M	NO
Alarms							
A0	High and low temperature alarm reset differential	2	0.1	20	°C/°F	S	YES
A1	Alarm thresholds (AL, AH) relative to the set point St or absolute (ALA, AHA) 0 = relative, 1 = absolute	0	0	1	-	S	NO
A2	Alarm thresholds (AL2, AH2) relative to the set point St2 or absolute (ALA2, AHA2) 0 = relative, 1 = absolute	0	0	1	-	S	NO
A6	Configure compressor operation during external alarm (immediate or delayed) with fixed 15 min OFF time 0 = always OFF 100 = always ON	0	0	100	min	S	NO
A10	Configure solenoid/compressor control during external alarm (immediate or delayed) with fixed 15 min OFF time 0 = always ON 100 = always ON	0	0	100	min	S	NO
A11	Delay time for delayed external alarm 0 = Signal-only alarm	0	0	240	min	S	NO
AA	Assign probe for high (AH(AHA) and low (AL/ALA) temperature alarms 0 Not configured 1 Outlet (Sm) 2 Defrost (Sd) 3 Intake (Sr) 4 Defrost 2 (Sd2) 5 Auxiliary 1 (Saux1) 6 Auxiliary 2 (Saux2) 7 Ambient (SA) 8 Reserved 9 Glass temperature (Svt) 10 Dew point (SdP) 11 Virtual probe (Sv)	1	0	11	-	S	YES
AA2	Assign probe for high (AH2, AHA2) and low (AL2, ALA2) temperature alarms - see AA	1	0	11	-	S	NO
AL	Low temperature alarm threshold (relative to set point)	4	0	50	°C/°F	S	YES
ALA *	Low temperature alarm threshold (absolute threshold)	0	-50	50	°C/°F	S	NO
AH	High temperature alarm threshold (relative to set point)	10	0	50	°C/°F	S	YES
AHA *	High temperature alarm threshold (absolute threshold)	0	-50	200	°C/°F	S	NO
AL2	Low temperature alarm threshold 2	0	0	50	°C/°F	S	NO
ALA2 *	Low temperature alarm threshold 2 (absolute threshold)	0	-50	50	°C/°F	S	NO
AH2	High temperature alarm threshold 2	0	0	50	°C/°F	S	NO
AHA2 *	High temperature alarm threshold 2 (absolute threshold)	0	-50	200	°C/°F	S	NO
Ad	Delay time for high and low temperature alarms (AH/AHA, AL/ALA)	120	0	240	min	U	YES
Ad2	Delay time for high and low temp. alarms (AH2/AHA2, AL2/ALA2)	30	1	240	min	U	NO
Ar	Signal alarms from Secondary to Main 0 = not enabled, 1 = enabled	1	0	1	-	S	NO
Add	High temperature alarm bypass time for door open	30	1	240	min	U	NO
Tdoor	Door open: alarm delay	30	1	240	min	S	NO
Htd	HACCP alarm delay - 0 = monitoring disabled	0	0	240	min	S	NO
Notice *: for alarms with an absolute activation threshold (A1=1) the thresholds ALA/ALA2 and AHA/AHA2 need to be set correctly (default full scale, absolute alarms disabled).							
RTC (Real Time Clock)							
y__	Date/time: year	-	17	99	-	S	NO
M_	Date/time: month	-	1	12	-	S	NO
d__	Date/time: day of the month	-	1	31	-	S	NO
h__	Date/time: hour	-	0	23	-	S	NO
m__	Date/time: minute	-	0	59	-	S	NO
u__	Date/time: day of the week	-	0	7	-	S	NO
Connectivity							
In	Type of unit 0 = Secondary, 1 = Main	0	0	1	-	S	YES
H0	Serial or Main/Secondary network address	199	1	247	-	S	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
H1	BMS serial port configuration (stop bits and parity) 0 1 stop bit, no parity 1 2 stop bit, no parity 2 1 stop bit, even parity 3 2 stop bits, even parity 4 1 stop bit, odd parity 5 2 stop bit, odd parity	1	0	5	-	S	YES
H2	BMS serial port baudrate (bit/s) 0 1200 1 2400 2 4800 3 9600 4 19200 5 38400 6 57600 7 115200	4	0	8	-	S	YES
H3	BMS port serial protocol 0 = Carel, 1 = Modbus	1	0	1	-	S	YES
Fieldbus							
Sn	Number of Secondary devices in the local network 0 = no Secondary devices (not available for VCC models)	0	0	5	-	S	YES
H4	FBus serial port baud rate (bit/s) 0 1200 1 2400 2 4800 3 9600 4 19200 5 38400 6 57600 7 115200 8 375000	4	0	8	-	S	NO
Notice: on fixed DEFAULT values for VCC serial							
Display							
/5	Unit of measure 0 = °C/barg, 1 = °F/psig	0	0	1	-	S	YES
/6	Display decimal point 0 = Yes, 1 = No	0	0	1	-	S	NO
/t1	Display on user terminal 0 Terminal disabled 1 to 3 Probe 1 to 3 4 to 8 Reserved 9 Control probe 10 Virtual probe 11 to 14 Serial probe 1 to 4 15 Temp. set point	9	0	15	-	S	NO
H5	Enable keypad and NFC functions 0 = Disabled, 1 = Enabled	1	0	1	-	U	NO
H8	Buzzer 0 = No, 1 = Yes	1	0	1	-	U	NO
ON	Unit On/Off command on display	1	0	1	-	S	NO
ONK	Enable unit On/Off from display	1	0	1	-	S	NO
ONS	Enable unit On/Off from supervisor	0	0	1	-	S	NO
Day/Night							
tS1..8-d	Start time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	S	NO
tS1..8-hh	Start time band 1 to 8 day: hours	0	0	23	hours	S	NO
tS1..8-mm	Start time band 1 to 8 day: minutes	0	0	59	minutes	S	NO
tE1..8-d	End time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-hh	End time band 1 to 8 day: hours	0	0	23	hours	S	NO
tE1..8-mm	End time band 1 to 8 day: minutes	0	0	59	minutes	S	NO
Periodic logs							
Log_h	Periodic log: hours (start sampling)	0	0	23	hours	S	NO
Log_m	Periodic log: minutes (start sampling)	0	0	59	minutes	S	NO
Maintenance counters							
HMP	Unit operating hour threshold (in thousands)	0	0	45	hours	S	NO
HMr	Reset operating hours parameter and maintenance warning	0	0	1	-	S	NO
HMc	Threshold for number of days until next unit maintenance	-1	-1	3650	days	S	NO
Generic function							
GFS_E	Display on user terminal 0 Always 1 Unit ON 2 Unit OFF 3 Defrost 4 Clean 5 Continuous cycle 6 Duty setting 7 Standby 8 Control 9 Door open 10 Alarm active	0	0	10	-	S	NO
GFS_1	Generic On/Off function: control probe 1 0 Not configured 1 Outlet temperature (Sm) 2 Defrost temp. (Sd) 3 Intake temperature (Sr) 4 Defrost temp. 2 (Sd2) 5 Auxiliary 1 (Saux1) 6 Auxiliary 2 (Saux2) 7 Ambient temp. (SA) 8 Ambient humidity (SU) 9 Glass temperature (Svt) 10 Dew point (SdP) 11 Virtual probe (Sv)	0	0	11	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFS_1	0	0	11	-	S	NO
GFS_T	Generic On/Off function: type 0 = Direct, 1 = Reverse	0	0	1	-	S	NO
GFS_S	Generic On/Off function: set point	0	-50	50	°C/°F	S	NO
GFS_D	Generic On/Off function: differential	0	0.0	99.9	°C/°F	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
				10	-	S	NO
GFM_1	Generic modulating function: control probe 1- see GFS_1	0	0	11	-	S	NO
GFM_2	Generic modulating function: control probe 2- see GFS_1	0	0	11	-	S	NO
GFM_T	Generic modulating function: type 0 = Direct, 1 = Reverse	0	0	1	-	S	NO
GFM_S	Generic modulating function: set point	0	-50	50	°C/°F	S	NO
GFM_D	Generic modulating function: differential	0	0	99.9	°C/°F	S	NO
GFM_Kp	Generic modulating function: proportional gain	0	0	100	-	S	NO
GFM_Td	Generic modulating function: derivative time	0	0	100	-	S	NO
GFM_Ti	Generic modulating function: integral time	0	0	900	-	S	NO
GFM_CD	Generic modulating function: cut-off differential	0	0	20	-	S	NO
GFM_H	Generic modulating function: hysteresis	0	0	20	-	S	NO
GFM_Max	Generic modulating function: max output value	0	0	100	-	S	NO
GFM_Min	Generic modulating function: min output value	0	0	100	-	S	NO
/Ad	Generic modulating function: analogue output 0 = disabled, 1 = Y1, 2 = Y2	0	0	2	-	S	NO
GFA_E	Generic alarm function: enable - see GFS_E	0	0	10	-	S	NO
GFA_1	Generic alarm function: control probe 1 - see GFS_1	0	0	14	-	S	NO
GFA_2	Generic alarm function: control probe 2 - see GFS_1	0	0	14	-	S	NO
GFA_De	General alarm function: delay	0	0	254	-	S	NO
GFA_ AlType	Generic alarm function: type 0 = Warning, 1 = Serious	0	0	1	-	S	NO
GFA_AA	Generic On/Off function: control probe 1 0 no action; 2 reduce control capacity 1 stop control; 3 lights off	0	0	3	-	S	NO
GFA_n	Generic alarm function: number of occurrences for semi-automatic alarm reset	0	0	99	-	S	NO
GFA_P	Generic alarm function: time period to monitor semi-automatic alarm reset	0	0	999	-	S	NO
GFA_r	Generic alarm function: reset type 0 = automatic 3 = semi-automatic 2 = manual	0	0	2	-	S	NO
GFA_D	Generic alarm function: differential	0	0	99.9	-	S	NO
GFA_Hth	Generic alarm function: high temperature threshold	0	-50	50	-	S	NO
GFA_Lth	General alarm function: low temperature threshold	0	-50	50	-	S	NO
GFA_We	Generic alarm function: enable warning 0= not active, 1 = active	0	0	1	-	S	NO
GFA_WA	Generic alarm function: action to be performed when warning activated 0 no action; 2 reduce capacity 1 stop control; 3 lights off	0	0	3	-	S	NO
GFA_WDe	Generic alarm function: warning activation delay	0	0	30000	s	S	NO
GFA_WD	Generic alarm function: warning reset differential	0	0	99.9	-	S	NO
GFA_ WHth	General alarm function: high warning threshold	0	-50	200	-	S	NO
GFA_ WLth	General alarm function: low warning threshold	0	-50	200	-	S	NO
Compressor overvoltage protection (HLVP)							
uEn	Enable compressor overvoltage protection function	0	0	1	-	S	NO
udE	Enable alarms on display	0	0	1	-	S	NO
uLo	Power cut-off low threshold	195	0	350	V	S	NO
uLi	Power cut-in low threshold	205	0	350	V	S	NO
uHo	Power cut-off high threshold	255	0	350	V	S	NO
uHi	Power cut-in high threshold	245	0	350	V	S	NO
ucd	Compressor switch-off delay if HLPV thresholds are exceeded	5	5	60	s	S	NO

Tab. 6.b

6.2 Configuring the MPXzero controller via the APPLICA app

The "Applica" app can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication) or BLE (Bluetooth Low Energy).
The app is used to configure the commissioning parameters and set groups of preset parameters according to specific needs (configurations).

Procedure:

1. download the CAREL "Applica" app from the Google Play Store or Apple Store (for the latter, Bluetooth version only);
2. (on the mobile device) start the app for commissioning the controller;
3. activate NFC and/or BLE;
4. If using an NFC connection: move the device near to the controller, maximum distance 10 mm, to upload the configuration parameters;
5. If using a BLE connection (*):
   1. select "BLUETOOTH SCAN" to view the MPXzero devices available within a range of 10 m.
   2. select the device to connect to

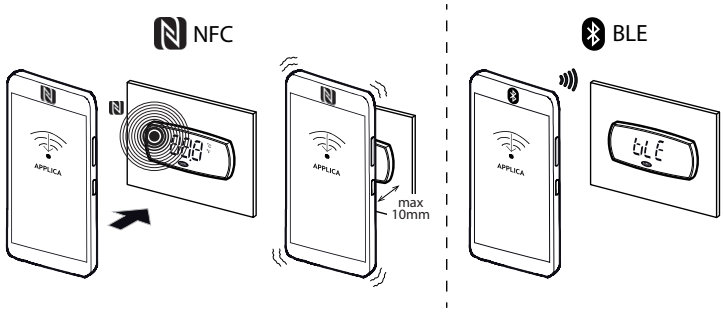


Fig. 6.a

Notice: for Bluetooth connections, geolocation may been to be enabled on the mobile device in order to view the list of available controllers. This depends on the Android operating system.

Notice: when first connecting, the devices will be identifiable by the UID code shown on the product label. Once the connection has been established (HMI shows the message "bLE"), the device can be renamed.

Notice: during the first connection, the Applica app aligns itself with the software version on the MPXzero controller via a cloud connection; this means a mobile data connection is needed at least for this first connection. If the data connection is not available, the required packet can be retrieved from the could as soon as the connection is restored (access the packet manager section of APPLICA).

Applica makes it easy to set the parameters on the MPXzero controller and manage parameter configurations using the hamburger menu at the top left of the screen.

6.2.1 Configurations

Parameter configurations can be created and saved, and then uploaded to the MPXzero controller using the configuration software or APPLICA app.
Configurations can be created either using the default values loaded by Carel, or starting from user-set values on the controller MPXzero, or alternatively only certain specific values can be modified.

To create a configuration using the SPARK configuration software - released under license directly by Carel - and starting from the default values on the controller, connect the PC to connector J4 BMS (RS485) using converter P/N CVSTDUMOR0, as shown in the figure

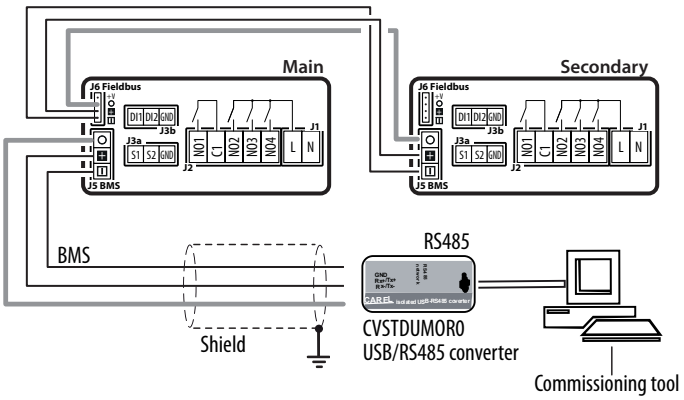


Fig. 6.b

Proceed as follows:
1. After starting the configuration software, from the "File" tab open the commissioning file (workspace) provided by Carel
2. In the "Target" tab add a "target", i.e. the MPXzero controller to communicate with.
3. Set the type of serial communication and change the connection parameters (default for MPXzero baud rate 19200, parity None and 1 stop bit)
4. Select "Connect".
5. From the "Configurations" tab, select "Add configuration" (e.g. MyConfiguration1).
6. After having created and selected the chosen configuration, select "Copy values to configuration".
7. The "Configuration value" column will now be populated with the current values on the MPXzero controller. The values can now be modified to create a custom configuration.
8. The configuration thus created can be immediately loaded onto the MPXzero controller by selecting "Apply
9. configuration" or saved for future uses by selecting "Export configuration".

Notice: to create a configuration based on the default values loaded by Carel on the MPXzero controller, simply follow the same procedure as described above, and in step 6 select "Apply default values" rather than "Copy values to configuration".

6.2.2 Profiles

Different profiles can be created for displaying the parameters using the configuration software.
Proceed as follows:
1. After starting the configuration software, open the commissioning file provided by Carel;
2. From the "Profiles" tab select "Add profile";
3. Select "Profiling"';
4. Select the variables to assign to the profile. These will only be the variables that are visible via the configuration/commissioning software and the Applica app to any M-level user who has the password for profile MyProfile1.
5. Now, selecting profile MyProfile1, the variables to assign to the profile as read-only can be selected by checking the check box in the corresponding column;
6. Select "Edit" to set the password associated with the profile;
7. The profile is now ready to be exported; select "Export profile" and upload it to the cloud service used by the Applica app.

7. TECHNICAL SPECIFICATIONS

Physical specifications	
Dimensions	See figures
Case	Polycarbonate
Mounting	panel
Ball pressure test temperature	125°C
Ingress protection	IEC: IP20 rear - IP65 front UL: Type 1
Front cleaning	Use soft, non-abrasive cloth and neutral detergent or water

Environmental conditions	
Storage conditions	-20T60 °C, <90% RH non-condensing
Operating conditions	-20T85 °C, <90% RH non-condensing

Electrical specifications	
Rated power supply	100-240Vac
Operating power supply voltage	90-264Vac
Input frequency (AC)	50/60 Hz
Maximum current draw	100mArms
Min power consumption	700mW
Clock	Precision: 20 ppm at 25°C; 100 ppm in the temperature range -20T60 °C. Date/time storage with controller off up to 2 years (-20T60°C).
Software class and structure	A
Pollution degree	2
Class of protection against electric shock	To be incorporated in class I or II appliances
Type of action and disconnection	1.C
Rated impulse voltage	100 - 240 Vac input and relay output: 2.5 kV
Surge immunity category	100 - 240 Vac input and relay outputs: II
Control device construction	Device to be incorporated
Terminal block	NO1, C1, NO2, NO3, NO4, L, N: • Removable male-female 30-12 AWG/0.05-3.3 mm2 • Screw terminals 30-14 AWG/0.05-2 mm2 S1, S2, S3, DI1, DI2, GND: • Removable male-female 30-17 AWG/0.05-1 mm2 • Screw terminals 30-17 AWG/0.05-1 mm2 BMS: • Removable male-female 30-17 AWG/0.05-1 mm2 FieldBus / Analogue outputs / VCC serial or frequency: • JST ZH connector 32-26 AWG/0.03-0.13 mm2

User interface	
Buzzer	built-in
Display	built-in, 3 digits, decimal point, and multi-function icons
Keypad	3 buttons

Connectivity	
NFC	Max distance 10mm, variable according to the mobile device used
Bluetooth Low Energy	Max distance 10m, variable according to the mobile device used
BMS serial interface	RS485 not optically-isolated
FieldBUS serial interface.	RS485 not optically-isolated

Analogue inputs (Lmax=10m)	
S1, S2, S3: NTC / PT1000	NTC: resolution 0.1°C; 10 kΩ@25°C; beta 3435; error: ±1 °C in the range -50T50°C, ±3 °C in the range 50T90°C PT1000: resolution 0.1°C; 1 kΩ@0°C; error: ± 1°C in the range - 60T120°C

Digital inputs	
DI1, DI2	Voltage-free contact, not optically-isolated, typical closing current 6 mA, voltage with contact open 13 V, max contact resistance 50Ω

Analogue outputs	
Y1, Y2, independently configurable as DC or PWM outputs	0-10V: 1kΩ, 10 mA max - PWM: 100 Hz, max amplitude 10V, 10 mA max

Digital outputs	
	NO1 (2 hp): EN60730: 10(6) A, 250 Vac; UL60730: 16A, 250 Vac; 8FLA, 48LRA, 250 Vac; Pilot duty B300, 250 Vac
	NO2 (8 A): EN60730: 8(3) A, 240 Vac; UL60730: 8A, 240 Vac; 2FLA, 12LRA, 240 Vac; Pilot duty C300, 240 Vac NO3, NO4 (5 A): EN60730: 5(1) A, 240 Vac; UL60730: 5A, 240 Vac; 1FLA, 6LRA, 240 Vac; Pilot duty C300, 240 Vac

Cable lengths	
Analogue inputs/outputs, digital inputs/outputs	<10 m

BMS and Fieldbus serial cables	<500 m with shielded cable

Conformity

Electrical safety compliance - LVD directive and certification	IEC/EN/UL 60730-1, CSA E60730-1, IEC 60335-1 (sections 29 & 30)
Electromagnetic compatibility - EMC directive.	IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61000-6-3, IEC/EN 61000-6-4
Applications with flammable refrigerant gases	For use with flammable refrigerants, the controllers described in this document have been tested and found to comply with the following requirements of the IEC 60335 series standards: • Annex CC of IEC 60335-2-24: 2010, referred to in clause 22.109, and Annex BB of IEC 60335-2-89: 2010, referred to in clause 22.108; components that produce arcs or sparks during normal operation have been tested and found to comply with the requirements of UL/IEC 60079-15; • IEC/EN/UL 60335-2-24 (clauses 22.109, 22.110) for household refrigerators and freezers; • IEC/EN/UL 60335-2-40 (clauses 22.116, 22.117) for electric heat pumps, air conditioners and dehumidifiers; • IEC/EN/UL 60335-2-89 (clauses 22.108, 22.109) for commercial refrigerating appliances. The controllers have been verified for the maximum temperatures of all components, which during the tests required by IEC 60335 cl. 11 and 19 do not exceed 272°C. The acceptability of these controllers in the final application where flammable refrigerants are used needs to be reviewed and verified depending on the final application.
Wireless compliance	RED directive, FCC (section 15, subsection B), IC.

Tab. 7.a

7.1 Connector/cable table

Ref.	Description	Wiring terminals	Wire cross-section (mm^2)	Lmax (m)
L/N	Controller power supply	Removable screw terminal, 2-pin, pitch 5.08mm	0.05-3.3 (30-12 AWG)	10
S1, S2, S3	Probes	Removable screw terminal, 2x3 pin, pitch 3.5mm	0.05-3.3 (30-12 AWG)	10
ID1, ID2	Digital inputs	Removable screw terminal, 2x3 pin, pitch 3.5mm	0.05-3.3 (30-12 AWG)	10
NO1..NO3	Digital outputs (MPXzero Standard)	Removable screw terminal, 4-pin, pitch 5.08mm	0.05-3.3 (30-12 AWG)	10
NO1...NO4	Digital outputs (MPXzero Advanced)	Removable screw terminal, 5-pin, pitch 5.08mm	0.05-3.3 (30-12 AWG)	10
Y1, Y2	0-10V/PWM outputs	JST ZH connector, 4-pin, pitch 2 mm - Coded connection cable (see "Introduction")	0.03-13 (32-26 AWG)	10
BMS	BMS	Removable screw terminal, 3-pin, pitch 3.5 mm	0.05-1 (30-17 AWG)	500 with shielded cable
Fbus	Fbus	JST ZH connector, 4-pin, pitch 2 mm - Coded connection cable (see "Introduction")	0.03-13 (32-26 AWG)	500 with shielded cable
VCC	VCC serial output	JST ZH connector, 4-pin, pitch 2 mm - Coded connection cable (see "Introduction")	0.03-13 (32-26 AWG)	500 with shielded cable

Tab. 7.b

8. ALARMS AND SIGNALS

8.1 Signals

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

Code	Description
dEF	Defrost running
Ed1	Defrost on evaporator 1 ended by timeout
Ed2	Defrost on evaporator 2 ended by timeout
OFF	Switch OFF
Stb	Standby status
CLn	Clean status
dEA	End defrost in advance due to high temperature
SrC	Unit maintenance signal
uGH	Generic warning function - high threshold exceeded
uGL	Generic warning function - low threshold exceeded
MAn	Output status forced to manual mode

Tab. 8.a

8.2 Types of alarms

There are three types of alarms:
- system: EEPROM, communication, HACCP, high (HI and HI2) and low (LO and LO2) temperature;
- generic alarm function (warning/serious) (see Functions for the corresponding parameters).

The EEPROM memory alarm always shuts down the controller. The digital outputs can be configured to signal the alarm status, normally open or normally closed. See "Digital outputs". The controller indicates alarms due to faults on the controller itself, on the probes or in network communication between the Main and Secondary devices. An alarm can also be activated from an external contact, immediate or
delayed. See "Digital inputs". The display shows "IA" and at the same time the alarm icon (triangle) flashes and the buzzer is activated. If more than one error occurs, these are displayed in sequence. A maximum of 5 errors can be saved, in a FIFO list. The error log can be accessed from the user terminal, via supervisor or Applica app (BLE connection only).

8.2.1 Active alarms

Active alarms are signalled by the buzzer and the flashing of the ALARM icon. Pressing any button mutes the buzzer and displays the alarm code, alternating with the value shown on the display. Alarm activation is recorded in the alarm log.
If the alarm is reset automatically, the ALARM icon goes off, the alarm code is cleared from the list and the alarm reset event is recorded in the alarm log.

Procedure (alarm acknowledgement):
1. press any button: the buzzer is muted, the alarm code is shown on the display;
2. scroll the menu to access the section with the list of alarms;
3. when finished, press ESC and then PRG to exit.

Example
Display after HI error.

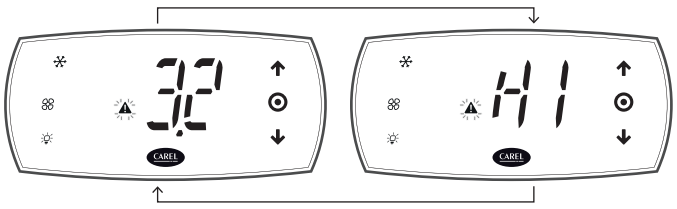


Fig. 8.a

The alarm log can be deleted via APPLICA on a smartphone, with BLE connection, using the specific function on the alarm page ("Service" level access is required).

Notice: deletion of the alarm log is irreversible.

8.3 Display alarm log

The alarm log can be displayed via the supervisor, the APPLICA app with Bluetooth connection or on the user interface.

Procedure:

1. press PRG until the display shows "---"
2. press PRG again until the display shows: "PSD";
3. enter the Password 33;
4. press UP/DOWN until reaching the ALM category; confirm by pressing PRG;
5. press UP/DOWN until displaying "HSt": a submenu is opened, where the UP and DOWN buttons can be used to scroll through the alarms, from HS0 to HS9;
6. select an alarm by pressing PRG and display the code, date, time, minutes and duration (if reset)
7. press ESC one or more times to retrun to the standard display.

Example:

'HI' -> 'y18' -> 'm11' -> 'd20' -> 'h17' -> 'm23' -> '65'
indicates that 'HI' (high temperature alarm) occurred on 20/11/2018 at 17:23 and lasted 65 minutes.

8.4 Alarm table

Display code	Description	Disp. icon flashing	Alarm relay	Buzzer	Reset	Compressor	Defrost	Evaporator fans	Continuous cycle	Comm. to LAN	Network solenoid valve
rE	Control probe		ON	ON	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
E1	Probe S1 fault		OFF	OFF	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
E2	Probe S2 fault		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E3	Probe S3 fault		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E11	Serial probe S11 not updated		OFF	OFF	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
E12	Serial probe S12 not updated		OFF	OFF	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
E13	Serial probe S13 not updated		OFF	OFF	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
E14	Serial probe S14 not updated		OFF	OFF	automatic	duty setting (c4)	unchanged	unchanged	unchanged	YES	NO
LO	Low temperature		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
HI	High temperature		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
LO2	Low temperature		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
HI2	High temperature		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
IA	Immediate alarm from external contact		ON	ON	automatic	duty setting (A6)	unchanged	unchanged	unchanged	YES	NO
dA	Delayed alarm from external contact		ON	ON	automatic	duty setting (A6) if A7≠0	unchanged	unchanged	unchanged	YES	NO
dor	Door open for too long		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Etc	Real time clock not updated		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
HA	HACCP type HA		OFF	OFF	manual	unchanged	unchanged	unchanged	unchanged	YES	NO
HF	HACCP type HF		OFF	OFF	manual	unchanged	unchanged	unchanged	unchanged	YES	NO
MA	Communication error with Main (only on Secondary)		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
u1...u5	Communication error with Secondary (only on Main)		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
n1...n5	Alarm on unit 1 to 9 in the network		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
GHI	Generic function: MAX threshold exceeded alarm		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO

Display code	Description	Disp. icon flash-ing	Alarm relay	Buzzer	Reset	Compressor	Defrost	Evaporator fans	Continu-ous cycle	Comm. to LAN	Network solenoid valve
GLO	Generic function: MIN threshold exceeded alarm	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	un-changed	YES	NO
VCC only											
UCF	VCC malfunction	⚠	ON	ON	Automatic	Off	unchanged	Off	un-changed	YES	NA
COM	No communication with compressor	⚠	ON	ON	Automatic	Off	unchanged	Off	un-changed	YES	NA
CHt	High condensing temperature alarm (dirty condenser)	⚠	ON	ON	Automatic	Off	unchanged	Off	un-changed	YES	NA
CUt	High condensing temperature warning (dirty condenser)	⚠	OFF	OFF	Automatic	unchanged	unchanged	unchanged	un-changed	YES	NA
PD	Maximum pump down time alarm	⚠	ON	ON	Automatic	Off	unchanged	off	Off	YES	NA
At5	Autostart in pump down	⚠	ON	ON	Automatic	unchanged	unchanged	unchanged	un-changed	YES	NA
LP	Low suction pressure alarm	⚠	ON	ON	Automatic	Off	Off	off	Off	YES	NA
EHI	Power overvoltage detected	⚠	ON	ON	Automatic	unchanged	unchanged	unchanged	un-changed	YES	NA
ELO	Power undervoltage detected	⚠	ON	ON	Automatic	unchanged	unchanged	unchanged	un-changed	YES	NA

Tab. 8.b

Notice: in the event of a permanent "Err" message on the display, contact service (possible display communication error).

8.5 Alarm parameters

Assign probe for high and low temperature alarms (parameters AA, AA2)

AA selects the probe to be used for measuring the high and low temperature alarms with reference to thresholds AL and AH. AA2 is the same as AA for thresholds AL2 and AH2.

Code	Description	Def	Min	Max	UOM	User	User terminal
AA	Assign probe for high (AH/AHA) and low (AL/ALA) temperature alarms 0 Not configured 1 Outlet (Sm) 2 Defrost (Sd) 3 Intake (Sr) 5 Reserved 6 Defrost 2 (Sd2) 7 Auxiliary 1 (Saux1) 8 Auxiliary 2 (Saux2) 9 Ambient (SA) 10 Reserved 11 Glass temperature (Svt) 13 Virtual probe (Sv)	1	0	13	-	S	YES
AA2	Assign probe for high (AH2,AHA2) and low (AL2,ALA2) temperature alarms - see AA	1	0	13	-	S	NO

Alarm parameters and activation

AL/ALA (AH/AHA) determine the activation threshold for the low (high) temperature alarm - LO (HI). The set value of AL/ALA (AH/AHA) is continuously compared against the value measured by the probe defined by parameter AA. 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/ALA for a time longer than Ad.

⚠ **Important:** the thresholds can be relative or or absolute, depending on the value of parameter A1:

- 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. The high temperature alarm, on the other hand, will be activated at the set point + AH.
- A1 = 1, the value of ALA indicates the absolute low temperature alarm threshold. If the set point changes, the activation point remains the same.

The low temperature alarm is signalled by the buzzer and code LO on the display. The same applies to the high temperature alarm (HI), with AH/AHA instead of AL/ALA.

Notice: the meaning of parameters AL2/ALA2, AH2/AHA2, AA2, A2 and Ad2 are similar to AL/ALA, AH/AHA, AA, A1 and Ad however relating to St2.

Notice: for alarms with an absolute activation threshold (A1=1) the thresholds ALA/ALA2 and AHA/AHA2 need to be set correctly (default 0).

Code	Description	Def	Min	Max	UOM	User	User terminal
A0	High and low temperature alarm reset differential	2	0.1	20	°C/°F	S	YES
A1	Alarm thresholds (AL, AH) relative to the set point St or absolute (ALA, AHA) 0 = relative, 1 = absolute	0	0	1	-	S	NO
A2	Alarm thresholds (AL2, AH2) relative to the set point St2 or absolute (ALA2, AHA2) 0 = relative, 1 = absolute	0	0	1	-	S	NO
A10	Configure solenoid/compressor control during external alarm (immediate or delayed) with fixed 15 min OFF time 0 = always OFF, 100 = always ON	0	0	100	min	S	NO
A11	Delay time for delayed external alarm 0 = Signal-only alarm	0	0	240	min	S	NO
AL	Low temperature alarm threshold (relative to set point)	4	0	50	°C/°F	S	YES
ALA *	Low temperature alarm threshold (absolute threshold)	0	-50	50	°C/°F	S	NO
AH	High temperature alarm threshold (relative to set point)	10	0	50	°C/°F	S	YES
AHA *	High temperature alarm threshold (absolute threshold)	0	-50	200	°C/°F	S	NO
AL2	Low temperature alarm threshold 2	0	0	50	°C/°F	S	NO
ALA2 *	Low temperature alarm threshold 2 (absolute threshold)	0	-50	50	°C/°F	S	NO
AH2	High temperature alarm threshold 2	0	0	50	°C/°F	S	NO
AHA2 *	High temperature alarm threshold 2 (absolute threshold)	0	-50	200	°C/°F	S	NO
Ad	Delay time for high and low temperature alarms (AH/AHA, AL/ALA)	120	0	240	min	U	YES
Ad2	Delay time for high and low temp. alarms (AH2/AHA2, AL2/ALA2)	30	1	240	min	U	NO

*: for alarms with an absolute activation threshold (A1=1) the thresholds ALA/ALA2 and AHA/AHA2 need to be set correctly (default full scale, absolute alarms disabled).

Notice:

- the LO (LO2) and HI (HI2) alarms are reset automatically. A0 represents the hysteresis between the alarm activation and deactivation value;
- for delayed alarms from digital input (dlb=3, code dA), the contact must remain open for a time greater than A11. When an alarm event occurs, a counter starts and generates an alarm when reaching the minimum time A11. 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 A10 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 A10 and remains off for a fixed time of 15 minutes.

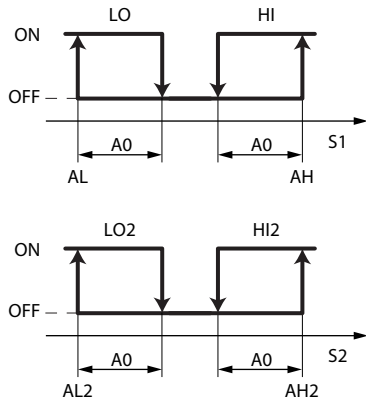


Fig. 8.b

Ref.	Description
LO, LO2	Low temperature alarms
HI, HI2	High temperature alarms
S1, S2	Probes

Signal alarms from Secondary to Main

The Main controllers, if Ar=1, can indicate when a Secondary in the LAN has an alarm. If an alarm occurs on a Secondary device, the Main controller shows the signal "nx", alternating with the temperature display, where x is the address of the Secondary with the alarm (x=1 to 9). If parameter DOb is set on the Main (value other than zero), then the Main alarm relay is also activated.

Code	Description	Def	Min	Max	UOM	User	User terminal
Ar	Signal alarms from Secondary to Main 0/1 = not enabled/enabled	1	0	1	-	S	NO

8.6 HACCP alarms

(HACCP = Hazard Analysis and Critical Control Point).

Specific alarms for controlling 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.); see "HACCP alarm parameters and control activation for HACCP" for details.
Two types of potentially critical HACCP events are managed:

- type HA alarms, high temperature during operation; example:
  The critical temperature was exceeded, the alarm was not managed and the temperature remained above the threshold for longer than the maximum tolerable time. (thresholds defined by site HACCP procedures). The event is critical and potentially hazardous.
- type HF alarms, high temperature after power failure; example:
  The unit was powered off. When restarted, the temperature is above the threshold and does not return to an acceptable level within an appropriate time. (parameters defined by site HACCP procedures). The event is critical and potentially hazardous.

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

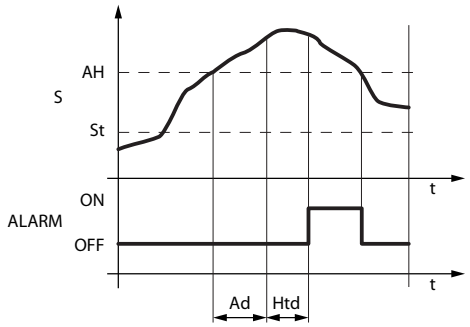
8.6.1 Parameters and control activation for HACCP

⚠ **Important:** for details on the actions to be taken following the alarms shown below, and for all configurations and parameters that have an impact on food safety, always refer to the HACCP procedures in the place of installation.

Type HA alarms

The type HA alarm is generated if during normal operation the temperature read by the probe set for parameter AA 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.

Code	Description	Def	Min	Max	UOM	User	User terminal
Htd	HACCP alarm delay 0 = monitoring disabled	0	0	240	min	S	NO



Ref.	Description
S	Measurement probe
St	Set point
AH	Low temperature alarm threshold
ALARM	Type HA HACCP alarm
Ad	Delay time for high and low temperature alarms
Htd	HACCP alarm delay - 0 = monitoring disabled
t	Time

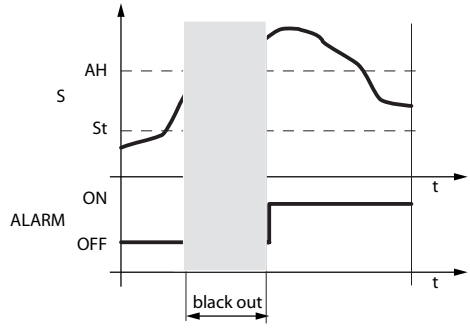
Fig. 8.c

Code	Description	Def	Min	Max	UOM	User	User terminal
Ht0 (*)	HACCP alarms present	0	0	1	-	S	NO
HAn (*)	Number of type HA alarms	0	0	15	-	S	NO

Type 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 probe set for parameter AA exceeds the high temperature threshold AH. HFn indicates the number of type HF alarms activated.

Code	Description	Def	Min	Max	UOM	User	User terminal
HFn (*)	Number of type HF alarms	0	0	15	-	S	NO



Ref.	Description
S	Measurement probe
St	Set point
AH	Low temperature alarm threshold
ALARM	Type HA HACCP alarm
t	Time

Fig. 8.d

(*) Parameters visible to supervisor and APPLICA.

9. LOGS

The MPXzero controller records data logs, which can be viewed and downloaded using the Applica APP (via Bluetooth for the mobile version) and the commissioning tools (Applica desktop version and Spark). To view the logs from Applica mobile, select the hamburger menu -> Data [1] -> Live / Logs (tab) [2].

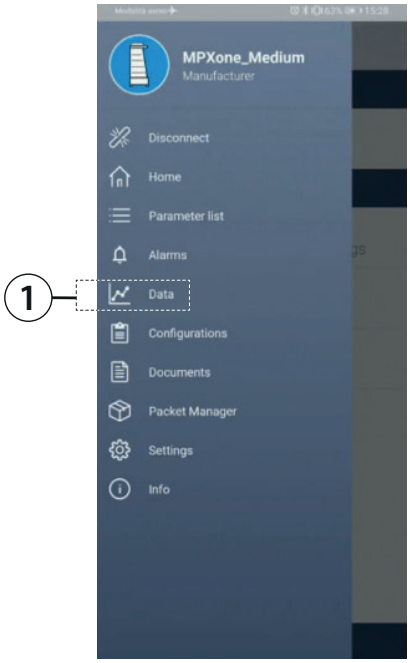


Fig. 9.a

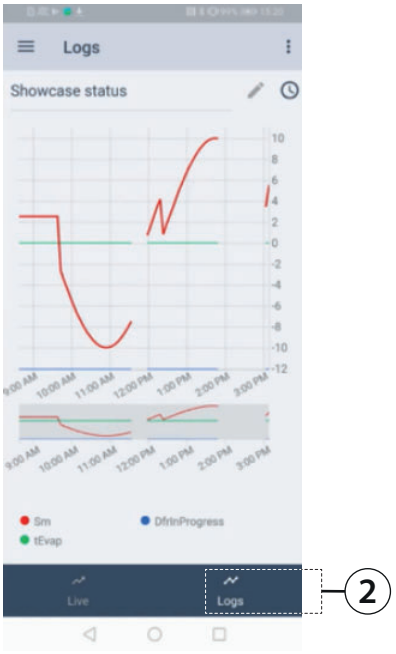


Fig. 9.b

Notice: remember to precisely set the time on the controller (RTC).
Notice: the start of logging must be set precisely using the specific parameters Log_h and Log_m, which define the exact moment when the controller will start logging the data.

The log view is pre-set, however it can be changed using the editing tools. In addition, the pre-set views loaded on the device allow the main values to be filtered (temperature, HACCP alarms, blackouts, etc.). To download the logs, use the drop-down menu at the top right.

Notice: in Applica mobile, the report format and email addresses of the default recipients can be set, as follows: Hamburger menu -> Settings -> Data management.

The logs can be used to record the main values of interest at regular intervals, with a default, non-modifiable sampling period of 5 minutes, guaranteeing 25 days of logged data.

Logged value	UoM	Sampling period
Outlet probe temperature (air off, Sm)	°C/F	5 min
Intake probe temperature (air on, Sr)	°C/F	5 min
Defrost probe temperature (Sd)	°C/F	5 min
Defrost status	-	5 min
Solenoid valve logical status (FOA)	-	5 min
Auxiliary compressor logical status (FOk)	-	5 min
Evaporator fan logical status (FOI)	-	5 min
Light logical status (FOE)	-	5 min

Tab. 9.a

10. RELEASE NOTES

Software version	Manual version	Description
1.2 **-01-2021	1.0 **-**-2021	First release

Notes

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