ENG

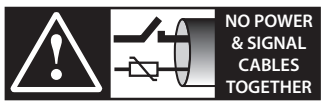
MPXPRO

Electronic controller for refrigeration applications

USER MANUAL

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS



READ CAREFULLY IN THE TEXT!

MPXPRO

+0300160EN - 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 emploYES 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

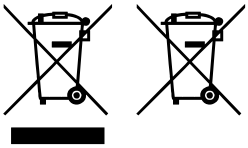


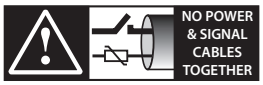
Fig. 1 Fig. 2

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:

Caution: 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.

Caution: 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

MPXPRO is a cutting-edge electronic controller designed for the advanced management of high-performance commercial refrigeration units: plug-ins, remote cabinets and cold rooms. The range comprises different versions, each designed to meet specific electronic valve control needs.

The main features of MPXPRO include:
- universal management of CAREL or PWM stepper valves with just one part number;
- up to three current sensors for accurate monitoring of power consumption and any abnormal loads;
- automatic Tx/Rx polarisation correction for error-proof BMS serial connection.

The user terminals integrate NFC and Bluetooth® connectivity for extending, via the CAREL "Applica" app, the features of traditional user interfaces, making these also available on mobile devices such as smartphones and tablets. The USB-C port also allows the device to be configured directly from a laptop, without having to power on the controller.

The solution is completed by the Spark and Sparkly support tools, ideal for complete management of the units during design and production.

1.1 Main functions and features

MPXPRO incorporates many of the features already present in the MPX range devices, such as MPXzero and MPXone Advanced, ensuring a family feeling between the different products. The main features include:
- compact 6 DIN module structure;
- 115/230Vac power supply;
- up to 3 current sensors for monitoring load power consumption (direct connection) and abnormal loads;
- direct control of bipolar stepper or PWM electronic expansion valves, depending on the version;
- up to 8 analogue inputs (maximum 3 configurable inputs for active probes);
- 3 dedicated digital inputs (up to 5 if not all analogue inputs are used);
- versions with 5 or 6 digital outputs (with 6 outputs, rating limited);
- up to 4 modulating 0-10 V / PWM outputs for controlling anti-sweat heaters, evaporator fans or variable speed compressors (VCC);
- up to 2 RS485 serial interfaces for connection to independent supervisory systems (Modbus protocol);
- USB-C port for device upgrades and configuration;
- commissioning tools (Spark, Sparkly) to optimise the control configuration;
- NFC wireless connectivity integrated into the HMI (Bluetooth® optional);
- M/S network management (main/secondary, up to 9 secondary devices);
- flooded evaporator management (Very Low SuperHeat – VLSH);
- defrosting activated via keypad, digital input, command from main network, supervisor or internal RTC timer;
- management of various types of defrosts, on one or two evaporators: heater, natural (compressor off);
- smart defrosting functions and network defrost coordination;
- control of cabinet lights and curtain;
- digital input broadcast from main to secondary devices;
- display secondary alarms on main;
- browse secondary unit menus from the main HMI;
- share one or more network probes;
- main gateway to supervisor for all secondary devices;
- HACCP alarm management.

1.2 Models and accessories

The available versions are divided into:

- **Entry**: for the management of bipolar stepper valves, without Ultracap module;
- **Stepper**: for the management of bipolar stepper valves, with integrated Ultracap;
- **PWM**: for the management of PWM electronic valves;
- **Universal**: for the management of bipolar stepper electronic valves (with integrated Ultracap) or PWM.

⚠ **Caution:** In case of power supply failure, models with integrated Ultracap allow the emergency closing of Carel bipolar stepper valves up to size E3V.

Additional variants available include the following options:
- number of digital outputs (relays): 5 (including 3 current sensors) or 6;
- Connector mounting: vertical or horizontal.

The product is offered in a single-pack version (equipped with connectors) or multi-pack version (connectors included or to be ordered separately, depending on the version). The table below lists the part numbers and specific features of each version.

P/N	Description
SPM00ENHRV040	MPXPRO Entry, for stepper valves, without Ultracap, 115-230 V, 5 relays, current sensors, vertical connectors
SPM00STHRV010	MPXPRO Stepper, for stepper valves, with Ultracap, 115-230 V, 5 relays, current sensors, vertical connectors
SPM00STHRH070	MPXPRO Stepper, for stepper valves, with Ultracap, 115-230 V, 5 relays, current sensors, horizontal connectors
SPM00STHPV050	MPXPRO Stepper, for stepper valves, with Ultracap, 115-230 V, 6 relays, vertical connectors
SPM00PWHRV020	MPXPRO PWM, for PWM valve, 115-230 V, 5 relays, current sensors, vertical connectors
SPM00PWHRH080	MPXPRO PWM, for PWM valve, 115-230 V, 5 relays, current sensors, horizontal connectors
SPM00PWHPV060	MPXPRO PWM, for PWM valves, 115-230 V, 6 relays, vertical connectors
SPM00UNHRV030	MPXPRO Universal, for stepper or PWM valves, with Ultracap, 115-230 V, 5 relays, current sensors, non-optoisolated RS485 EFM, vertical connectors
SPM00UNHRH090	MPXPRO Universal, for stepper or PWM valves, with Ultracap, 115-230 V, 5 relays, current sensors, non-optoisolated RS485 EFM, horizontal connectors

Fig. 1.a

A label is applied to the rear of the controller, containing the main product information:
- finished product code;
- product certifications;
- revision;
- place and date of manufacture;
- serial number;
- CCV control code;
- UID identifier.

Some of this information is also included in the data matrix printed both on the label and on the front of the controller, next to the USB-C port.

On the side of the controller, a tamper-proof warranty label is also present, preventing unauthorized opening of the device.

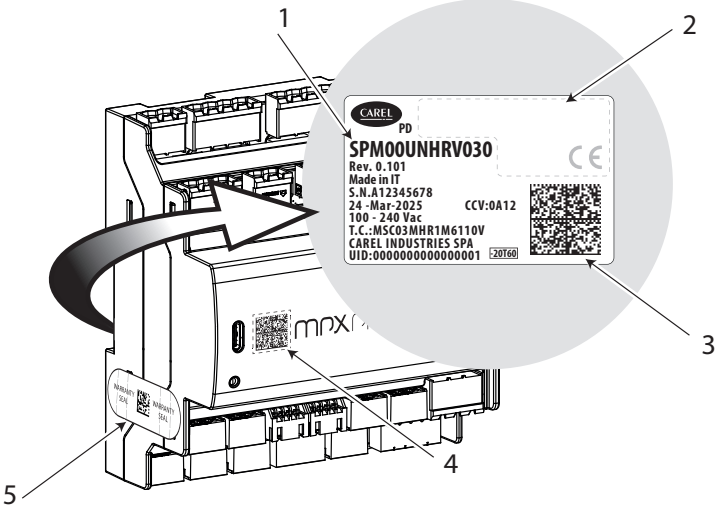


Fig. 1.b

Key:

1	Product part number
2	Product certifications
3, 4	Data matrix
5	Warranty label

1.2.1 User terminal and remote display

- The user terminal, to be ordered separately in the Type A or Type B versions (see the "User interface" chapter), is used to display and set the control parameters. NFC and Bluetooth® (BLE) connectivity makes it possible to interact with mobile devices, facilitating unit commissioning (it is recommended to install the CAREL "Applica" app for Android/iOS in advance).
- The repeater display (available only for the Type A version) can be connected as an accessory and comprises the display only, displaying alarms and a system temperature value, in °C or °F.

See "Installation" and the technical leaflet +0500142IE (Type A) /+0500175IE (Type B).

P/N	Description
AX3000PS2002*	Type A user terminal, NFC only, 4 buttons, buzzer
AX3000PS2003*	Type A user terminal, NFC+BLE, 4 buttons, buzzer
AX3000PS20X1*	Remote display, no connectivity
AX3100PS20X10	Remote display, no connectivity, no transparent frame
S00HSA0N00S0700	Type B user terminal, NFC only, 3 buttons, buzzer
S00HSA0B00S0656	Type B user terminal, NFC+BLE, 3 buttons, buzzer
S00HSA0B00S1004	Type B user terminal, NFC+BLE, 3 buttons, buzzer
S00HSA0N00S1003	Type B user terminal, NFC, 3 buttons, buzzer
S00HXA0B00S1010	Type B XL user terminal, HORIZONTAL NFC+BLE JST_TERM
ACS00CB00002*	JST/JST user terminal cable - 1.5 m long
ACS00CB00001*	JST/JST user terminal cable - 3 m long
ACS00CB00008*	JST/JST user terminal cable - 6 m long
ACS00CB0027A0	JST/JST user terminal cable - 0.5 m long, fixed colours
ACS00CB002790	JST/JST user terminal cable - 10 m long, fixed colours

* : 0/1 single/multiple pack (20 pcs.)

Fig. 1.c

1.2.2 Connector kit

Multi-pack options are available in variants with or without connectors (in the latter case to be ordered separately). Depending on the version of the controller, see the table below.

Notice: each MPXPRO model comes with two separate packs of connectors.

P/N	Description	Connectors 1 (*)	Connectors 2 (*)
SPM00STHRV011	MPXPRO Stepper, for stepper valves, with Ultracap, 115-230 V, 5 relays, current sensors, vertical connectors, multiple pack of 20 pcs.	MSCACSCK01VT0	MSCACSCK12VT0
SPM00PWHRV021	MPXPRO PWM, for PWM valve, 115-230 V, 5 relays, current sensors, vertical NO connectors, , multiple pack of 20 pcs.	MSCACSCK01VT0	MSCACSCK09VT0
SPM00UNHRV031	MPXPRO Universal, for stepper or PWM valves with Ultracap, 115-230 V, 5 relays, current sensors, EFM RS485 not opto-isolated, vertical NO connectors, multiple pack of 20 pcs	MSCACSCK01VT0	MSCACSCK04VT0

Tab. 1.a

(*) Each part number to be purchased in multiples of 20 pcs

Notice: the part numbers for the horizontal mounting terminal kits are obtained by replacing the digits "HZ" with "VT".

1.2.3 Temperature sensors

NTC***HP00

NTC***HF01

Fig. 1.d

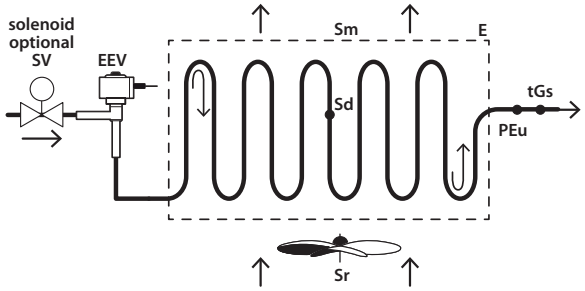
P/N	Type	Description	Range
NTC060HP00	10 kΩ±1%@25 °C, beta 3435 IP67	Cabinet ambient temperature probe	-50…50 °C (105°C in air)
NTC***HF01	10 kΩ±1%@25 °C, beta 3435 IP67	Evaporator outlet temperature probe	-50…90°C strap-on
NTC060WG00	10 kΩ±1%@25 °C, beta 3435 IP67	Glass temperature probe	-50T105°C in air
NTC***WH01	10 kΩ ±1% at 25 °C Beta 3435	Cabinet ambient temperature probe	-50T105 °C
PT1060HP01	PT1000 Classe B, IP67	Cabinet ambient temperature probe	-50T105°C in air
PT1***HF01	PT1000 Classe B, IP67	Evaporator outlet temperature probe	-50T105°C in air
DPWC111000	4...20 mA	Ambient temperature and humidity probe	-10T60 °C, 10 to 90% rH
DPWC115000	0...10 Vdc		
DPWS*	4-20 mA or 0-10 Vdc	Ambient temperature and humidity probe	-40T70°C 10-100 rH

Tab. 1.b

Notice:

- the glass temperature probe must be connected to the coldest point of the showcase glass, for optimum operation of the anti-sweat device (heaters or fans). See technical leaflet +050002005;
- see manual +040010025 (ITA- ENG) /+040010026 (FRE-GER) for guidelines on installing the sensors on the unit.

Example of operation with one evaporator on a vertical showcase



P/N	Description
EEV	Electronic expansion valve
SV	Solenoid valve
Sm	Outlet probe
Sr	Intake probe
Sd	Defrost probe
E	Evaporator
tGs	Superheated gas temperature probe
PEu	Saturated evaporation pressure/temperature probe

Fig. 1.e

1.2.4 Pressure sensors

SPKT0053P0

SPKT0043P*

SPKT0011D0

Fig. 1.f

P/N	Type	Range	Description
SPKT0043P0	0.5...4.5 V	0...17.3 barg	P series female ratiometric pressure transducer
SPKT0033P0	0.5...4.5 V	0...34.5 barg	P series female ratiometric pressure transducer
SPKT00B6P0	0.5...4.5 V	0...45.0 barg	P series female ratiometric pressure transducer
SPKT00G1S0	0.5...4.5 V	0...60.0 barg	S series female high performance ratiometric pressure transducer
SPKT00L1S0	0.5...4.5 V	0...90.0 barg	S series female high performance ratiometric pressure transducer
SPKT00G1C0	4...20 mA	0...120.0 barg	C series female pressure transducer
SPKT00H8C0	4...20 mA	0...120.0 barg	C series male pressure transducer

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

2. INSTALLATION

2.1 Warnings

Caution: 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).

Caution: before performing any maintenance operations, disconnect the controller from the power supply by switching the system's main circuit breaker to the 'OFF' position.

2.2 Dimensions - mm (in)

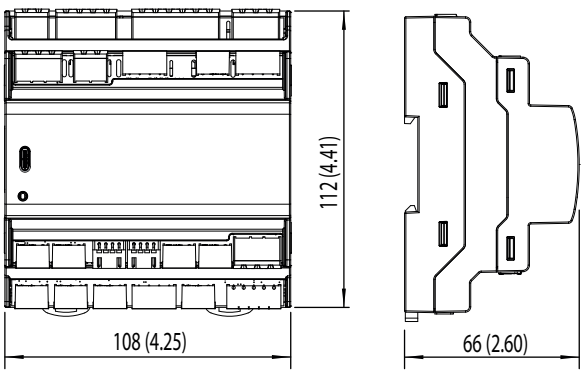
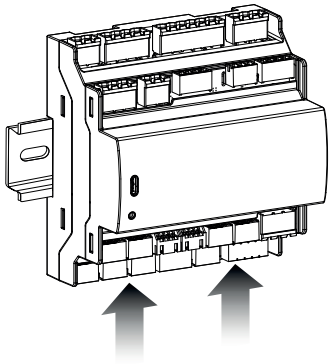


Fig. 2.a

2.3 Mounting

⚠ **Caution:** before performing any maintenance operations, disconnect the controller from the power supply by switching the system's main circuit breaker to the 'OFF' position.



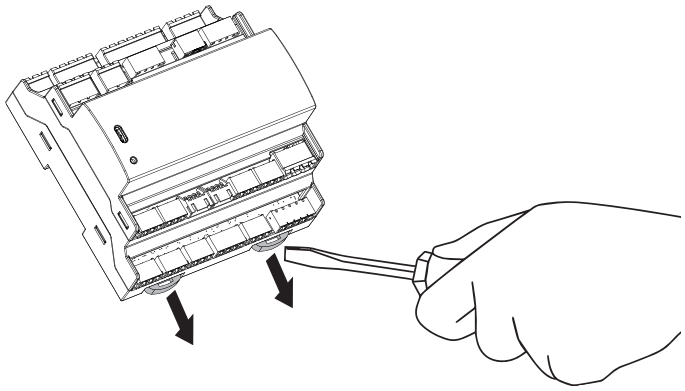
Thanks to the spring clips on the rear side of the controller, MPXPRO allows the maximum mounting flexibility.

Apply slight pressure to the controller resting on the DIN rail until the rear tab clicks into place.

Fig. 2.b

2.4 Removal

⚠ **Caution:** before performing any maintenance operations, disconnect the controller from the power supply by switching the system's main circuit breaker to the 'OFF' position.



Use a screwdriver as a lever in the hole to lift and release the tab. The tab is held in the locked position by return springs.

Fig. 2.c

2.5 Battery disposal

⚠ **Caution:** before performing any maintenance operations, disconnect the controller from the power supply by switching the system's main circuit breaker to the 'OFF' position.

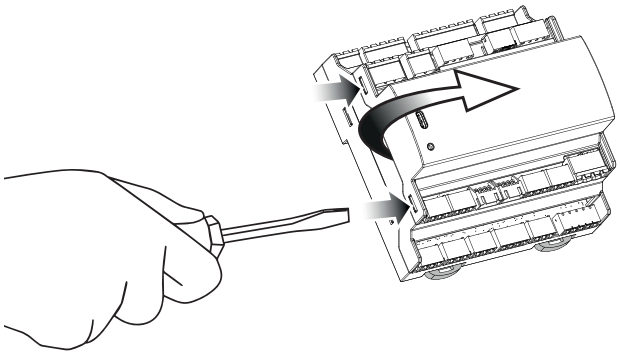


Fig. 2.d

❶ Use a screwdriver as a lever in the hole to lift and release the cover.

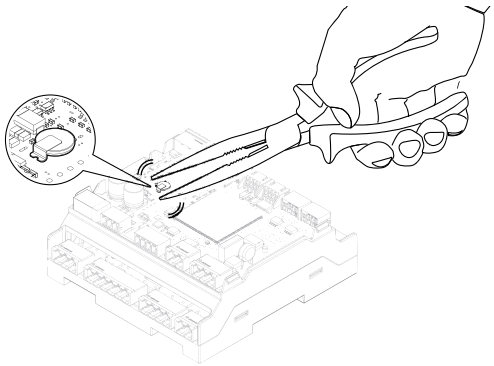


Fig. 2.e

❷ Grip the battery using pliers and twist it to remove it from its socket.

⚠ **Caution:** battery removal must only be carried out when disposing of the product.

2.6 Type A resistive HMI terminal

⚠ **Caution:** before performing any maintenance operations, disconnect the controller from the power supply by switching the system's main circuit breaker to the 'OFF' position.

2.6.1 Type A resistive HMI terminal dimensions – mm (in)

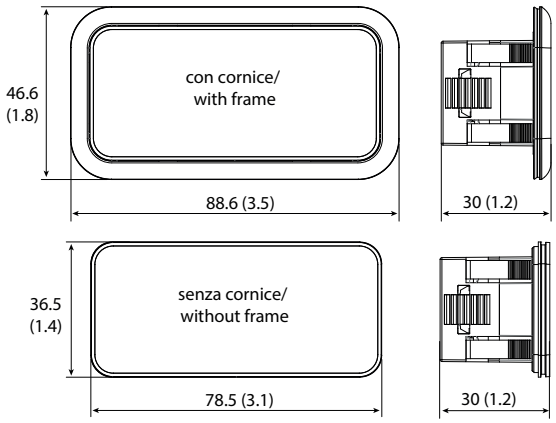


Fig. 2.f

2.6.2 Type A resistive HMI terminal frame mounting and removal

The user terminal is supplied with the frame already fitted. Nonetheless, this can be easily removed without affecting the IP protection rating.

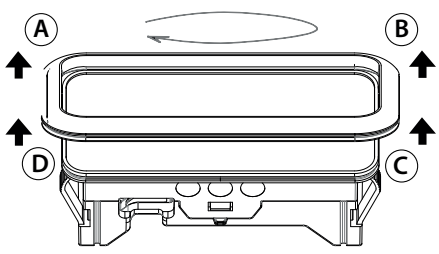
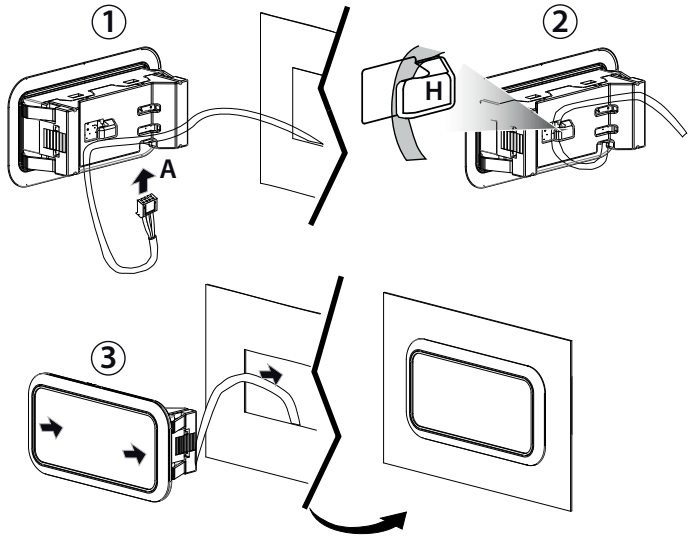


Fig. 2.g

Press the frame gently upwards at point A until hearing a click and repeat the operation at the other points B, C, D so as to detach the frame.

To reassemble the frame, repeat the removal operations in reverse order.

2.6.3 Mounting the type A resistive HMI terminal



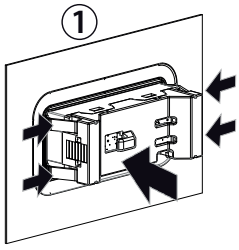
1. insert the cable from the electrical panel into point A;
2. run the cable through the cable gland H;
3. place the controller in the opening, press lightly on the side tabs and then on the front until fully inserted (the side tabs will bend, and the catches will attach the controller to the panel).

Fig. 2.h

Caution: IP65 front protection is guaranteed only if the following conditions are met:
- maximum deviation of the rectangular opening from flat surface: ≤ 0.5mm (0.02 in);
- thickness of the electrical panel sheet metal: 0.8 to 2 mm (0.03 to 0.1 in);
- 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 terminal.

2.6.4 Removing the type A resistive HMI terminal

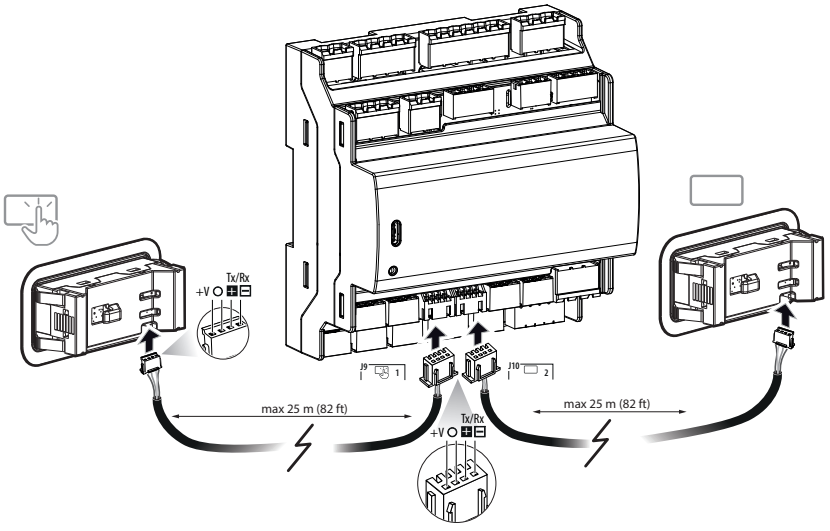


Open the electrical panel and from the rear:
1. gently press the side retaining tabs on the HMI terminal;
2. apply light pressure to the HMI terminal until it comes out.

Fig. 2.i

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

2.6.5 Connecting the type A resistive HMI terminal



Open the electrical panel and from the rear:
1. connect the 4-wire cable to the mini JST connector on the controller;
2. connect the 4-wire cable to the mini JST or screw connector on the HMI terminal.

Caution: pay attention to the order of the wires.

Notice: see "Introduction" for the cable part numbers.

Fig. 2.j

2.7 Type B capacitive HMI terminal

2.7.1 Type B capacitive terminal dimensions – mm (in)

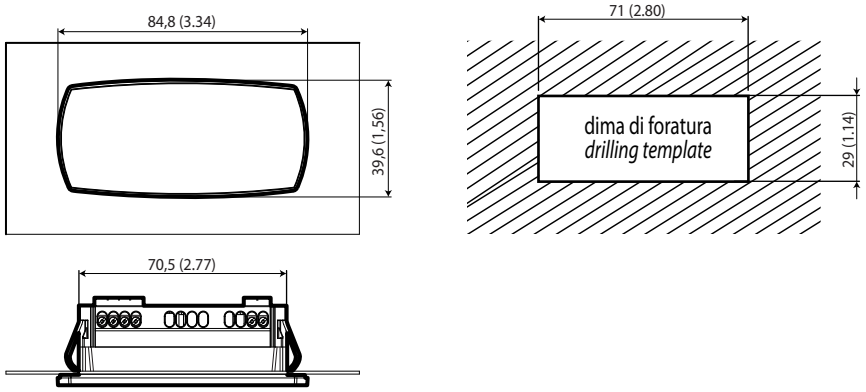


Fig. 2.k

2.7.2 Mounting the type B capacitive HMI terminal

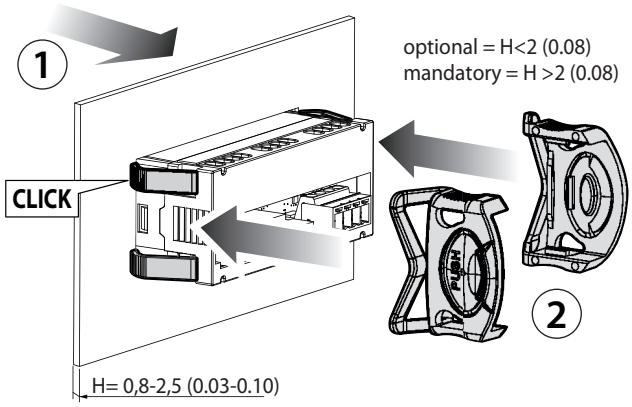


Fig. 2.l

1. Insert the HMI terminal into the opening by pressing lightly on the side retaining tabs;
2. Then press on the front until fully inserted (the side tabs will bend, and the catches will attach the HMI terminal to the panel, up to a maximum thickness of 2 mm);
3. If necessary, fit the fixing brackets.

Caution: 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 (0.08-0.10 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 terminal.

2.7.3 Removing the type B capacitive HMI terminal

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

Open the electrical panel and from the rear:
1. remove the fixing brackets (if fitted);
2. gently press the side retaining tabs on the HMI terminal;
3. apply light pressure to the HMI terminal until it comes out.

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

2.7.4 Connecting the type B capacitive HMI terminal

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

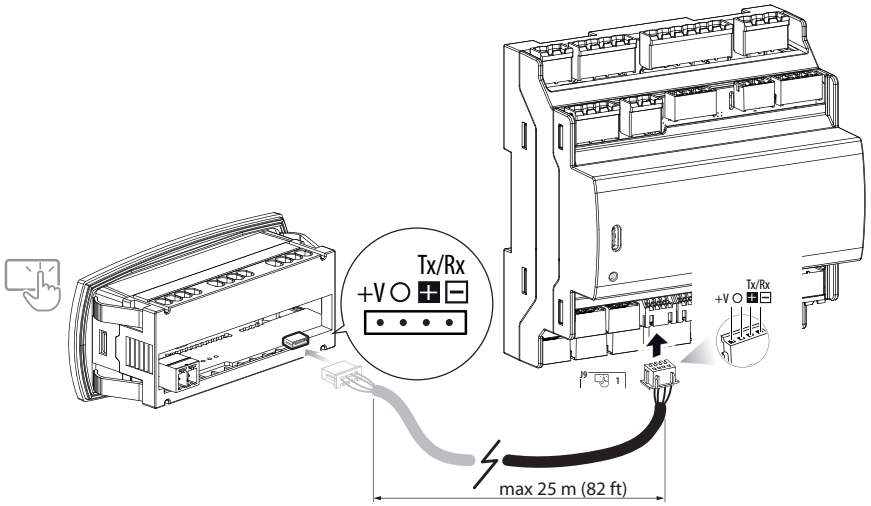


Fig. 2.m

Open the electrical panel and from the rear:
1. connect the 4-wire cable to the mini JST connector on the controller;
2. connect the 4-wire cable to the screw connector on the HMI terminal.

Caution: pay attention to the order of the wires.

Notice: see "Introduction" for the cable part numbers.

2.8 Description of the terminals

Caution: carefully check the wiring correspondence according to the labelling printed on the MPXPRO controller to avoid potential malfunctions or damage.

5-relay models

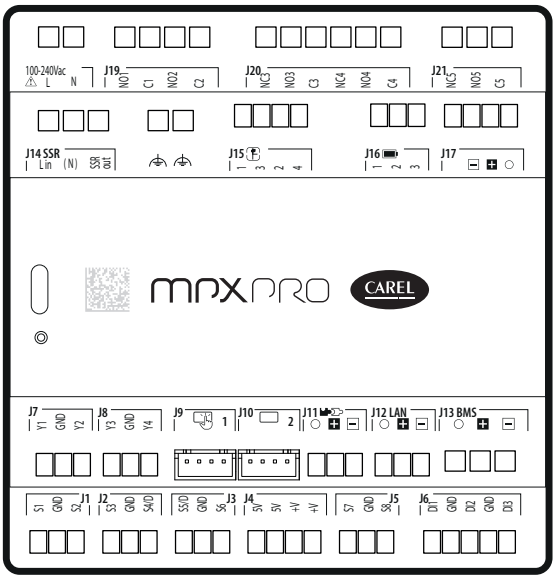


Fig. 2.n

6-relay models

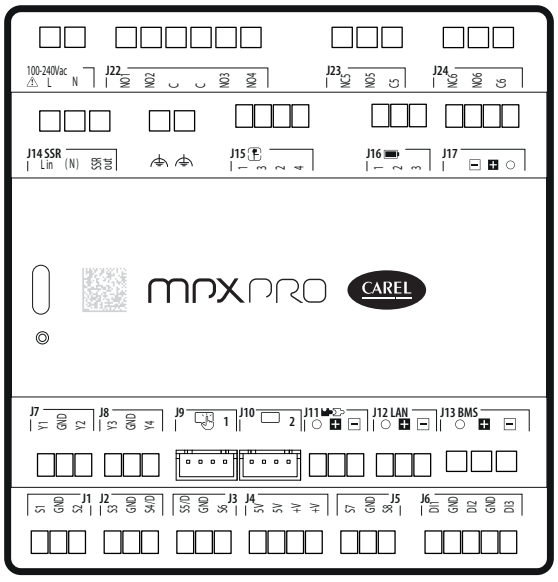


Fig. 2.o

Caution: the terminal block sequence is identical for both horizontal and vertical connector versions. However, in the case of horizontal-vertical terminal block configurations, the plug-in terminals are rotated by 180°, and wiring must be adapted accordingly.

Ref.		Description
115-230 VAC	L	Power supply
	N	
J1	S1	Analogue input 1 (NTC, PT1000)
	GND	Reference for probes, digital inputs and analogue outputs
	S2	Analogue input 2 (NTC, PT1000) (*)
J2	S3	Analogue input 3 (NTC, PT1000) (*)
	GND	Reference for probes, Digital inputs and analogue outputs
	S4/D	Digital inputs 4 voltage-free contact, not opto-isolated/ Analogue input 4 (NTC, PT1000) (*)
J3	S5/D	Digital inputs 5 voltage-free contact, not opto-isolated/ Analogue input 5 (NTC, PT1000) (*)
	GND	Reference for probes, Digital inputs and analogue outputs
	S6	Analogue input 6 (NTC, PT1000, 4...20 mA, 0...10 V, NTC-HT, 0.5...4.5 V)
J4	5V	5 Vdc power supply for ratiometric probes.
	+V	11-13 V power supply for 4-20 mA probes
J5	S7	Analogue input 7 (NTC, PT1000, 4...20 mA, 0...10 V, NTC-HT, 0.5...4.5 V)
	GND	Reference for probes, Digital inputs and analogue outputs
	S8	Analogue input 8 (NTC, PT1000, 4...20 mA, 0...10 V, NTC-HT, 0.5...4.5 V)
J6	DI1	Digital input 1; voltage-free contact, not opto-isolated
	GND	Reference for probes, Digital inputs and analogue outputs
	DI2	Digital input 2; voltage-free contact, not opto-isolated
	GND	Reference for probes, Digital inputs and analogue outputs
	DI3	Digital input 3; voltage-free contact, not opto-isolated
J7	Y1	Analogue output 1
	GND	Reference for probes, Digital inputs and analogue outputs
	Y2	Analogue output 2
J8	Y3	Analogue output 3
	GND	Reference for probes, Digital inputs and analogue outputs
	Y4	Analogue output 4
J9		Terminal connector
J10		Repeater terminal connector
J11		Not used
J12	O	Main-secondary network serial port (RS485): GND
	+	Main-secondary network serial port (RS485): Rx+/Tx+
	-	Main-secondary network serial port (RS485): Rx-/Tx-
J13	O	BMS serial port (RS485): GND
	+	BMS serial port (RS485): Rx+/Tx+
	-	BMS serial port (RS485): Rx-/Tx-

Ref.		Description	
J14	Lin	SSR line input	
	(N)	SSR neutral input (optional)	
	SSR out	SSR output	
⏚	-	Return connector for connection to the system earth / Valve cable shield connector	
J15		Carel ExV bipolar valve JST connector	
J16		Not used	
J17		BMS2 serial	
	-	Optional serial port (RS485, opto-isolated): Rx/Tx-	
	+	Optional serial port (RS485, opto-isolated): Rx/Tx+	
	O	Optional serial port (RS485, opto-isolated): GND	
J19	NO1	Digital output relay 1	5 relay version
	C1	Common for relay 1	
	NO2	Digital output relay 2	
	C2	Common for relay 2	
J20	NC3	Digital output (relay) 3 NC	
	NO3	Digital output (relay) 3 NO	
	C3	Common for relay 3	
	NC4	Digital output relay 4 NC	
	NO4	Digital output relay 4 NO	
	C4	Common for relay 4	
J21	NC5	Digital output relay 5 NC	
	NO5	Digital output relay 5 NO	
	C5	Common for relay 5	
J22	NO1	Digital output relay 1	6 Relais version
	NO2	Digital output relay 2	
	C	Common for relay 1, 2, 3, 4	
	C	Common for relay 1, 2, 3, 4	
	NO3	Digital output relay 3 NO	
	NO4	Digital output relay 4 NO	
J23	NC5	Digital output relay 5 NC	
	NO5	Digital output relay 5 NO	
	C5	Common for relay 5	
J24	NC6	Digital output relay 6 NC	
	NO6	Digital output relay 6 NO	
	C6	Common for relay 6	

Tab. 2.c

Notice: (*) if used as analogue inputs, S1, S2, S3, S4/D and S5/D must all be of the same type.

2.9 Electrical installation

Caution: installation must be carried out by qualified personnel only.

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.

Caution: :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; 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;
- all the extra low voltage connections (analogue and digital inputs, analogue outputs, serial bus connections, power supplies) must have reinforced or double insulation from the mains network.
- 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

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 controller cables have to cross over the power cables, the intersections must be as near as possible to 90 degrees, always avoiding running the controller cables parallel to the power cables.

2.9.1 Positioning inside the panel

The position of the controller in the electrical cabinet must be chosen so as to guarantee adequate 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. The controller can be mounted inside the panel without any particular orientation constraints.

2.9.2 Probe/digital input connection

Notice:
- all probes can be configured as NTC or PT1000;
- probes S6, S7 and S8 can be configured as NTC, PT1000, 0.5 V-4.5 V, 0-10 V or 4-20 mA;
- Inputs 4 and 5 can be configured not only as probes, but also as digital inputs.
- The "APPLICA" app can be used to change the configuration of the probes and digital inputs without having to re-wire.

NTC, PT1000

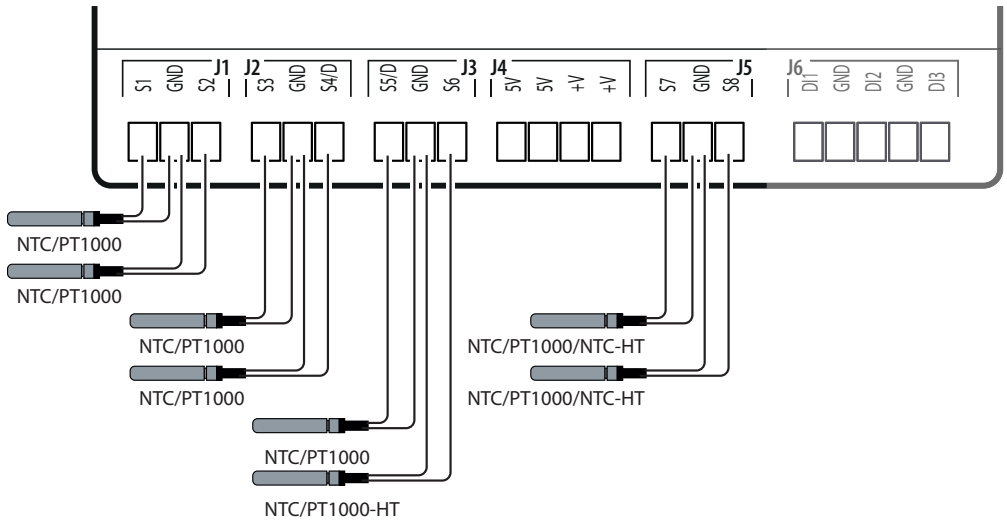
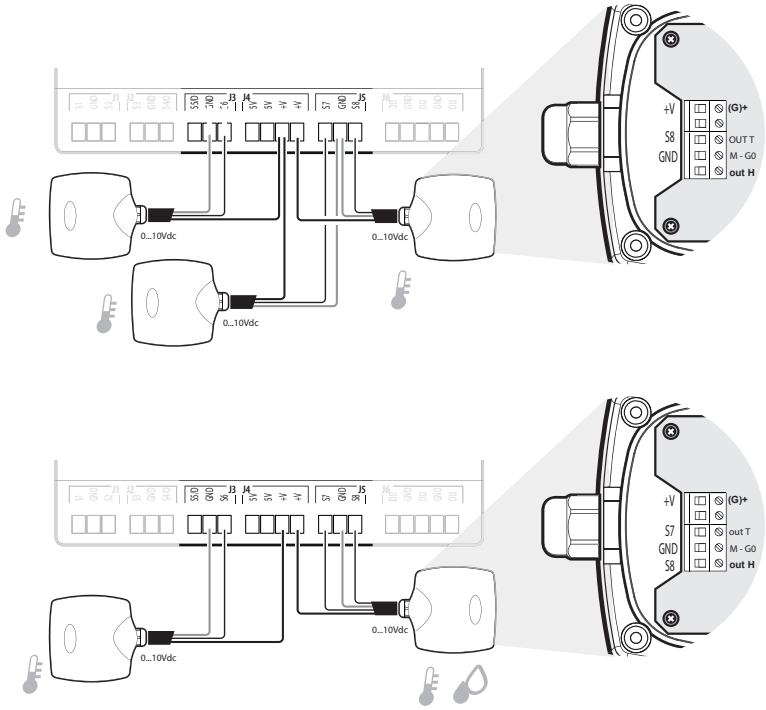


Fig. 2.p

0...10 V



Temperature only

Temperature/Humidity

Fig. 2.q

4..20 mA

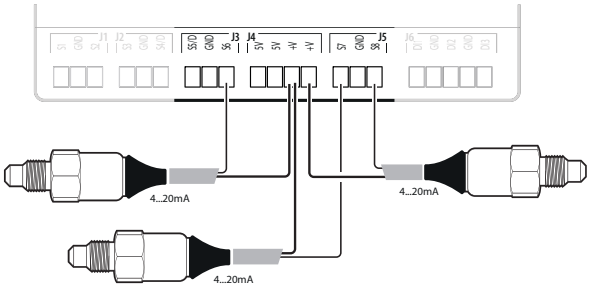


Fig. 2.r

0.5...4.5 V

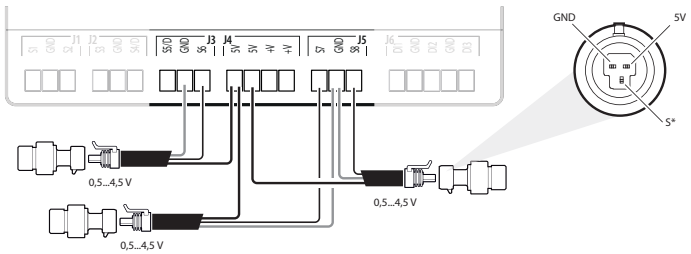


Fig. 2.s

Digital inputs

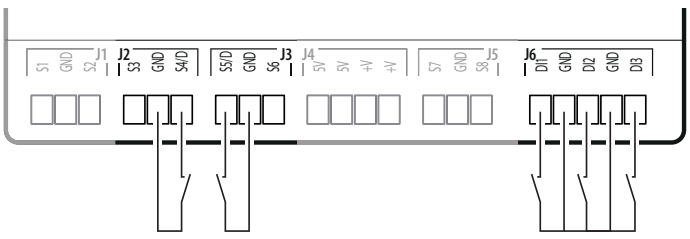


Fig. 2.t

2.9.3 Analogue and digital output connections

Analogue outputs

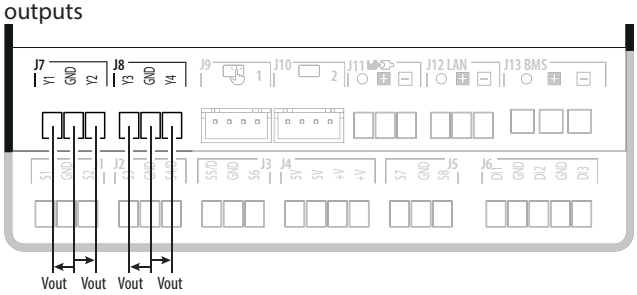


Fig. 2.u

Digital outputs - 5-relay version

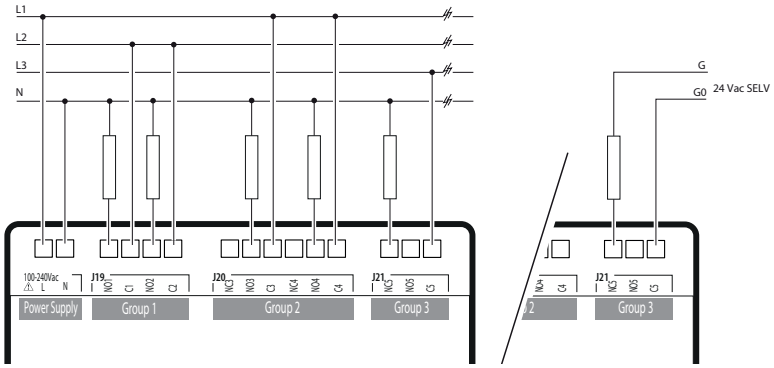


Fig. 2.v

Digital outputs - 6-relay version

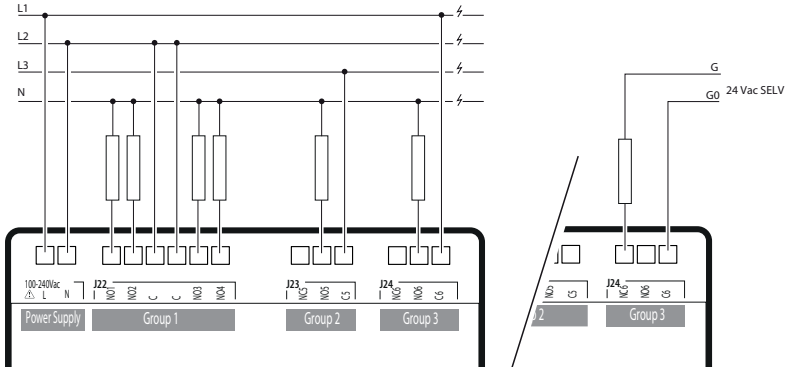


Fig. 2.w

Notice:

- the digital outputs are divided into groups. There is functional insulation between the power supply and the groups, and between the groups themselves. Between group 2 and group 3, reinforced insulation is provided. The diagrams show only one possible example of connection.
- the "APPLICA" app allows the relay functions to be reassigned in order to exploit their different load capacities if needed.

2.9.4 Carel EXV valve connection

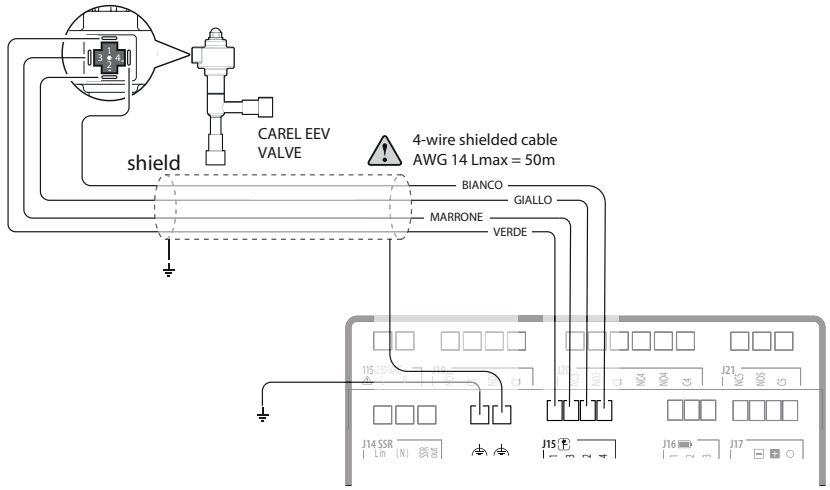


Fig. 2.x

Notice:

- If the shield is connected to the controller, an earth connection is mandatory.
- Some MPXPRO models are equipped with an internal Ultracap for emergency closing of Carel EXV valves. The use of the optional external Ultracap module is only necessary to ensure the closing of some valve models or if the MPX is not equipped an internal module. See "'Carel EXV valve"' for details.

2.9.5 PWM valve connection

Different PWM valve wiring configurations are possible, depending on whether the neutral (N) is connected directly or routed through the controller's (N) terminal.

Direct connection
(recommended for unshielded cables)

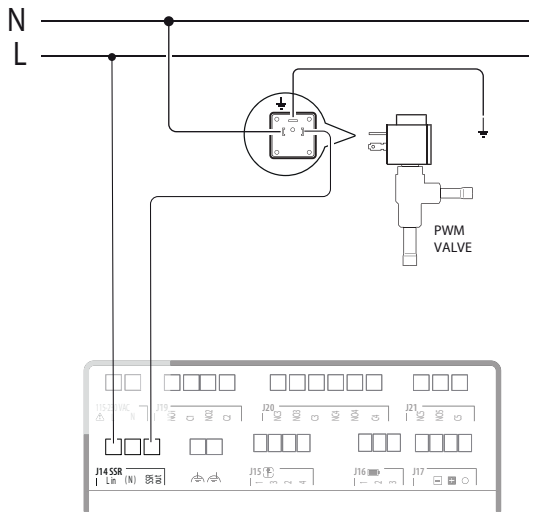


Fig. 2.y

Auxiliary neutral connection
(recommended for unshielded cables)

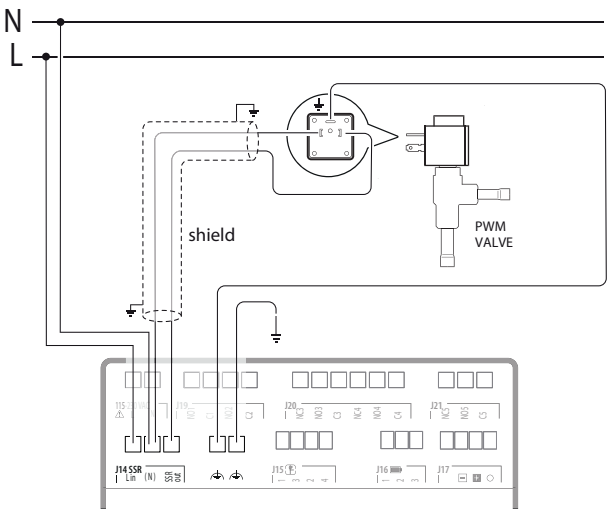


Fig. 2.z

Notice: solid state relay (SSR) output J14: for residential applications only, shielded cable earthed at both ends is required.

2.10 Serial port connections

For serial connections (LAN 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	Wire/wire capacitance (pF/m)	Resistance on first and last device	Max no. secondary devices on bus	Baud rate (bit/s)	Stop bits and parity
MPXPRO	LAN (J12)	(*)	<90	120 Ω	9	19200	2, None
PC (supervisor)	BMS (J13)	(*)	<90	120 Ω	246 (**)	19200 (***)	2, None (***)
PC (supervisor)	BMS 2 (J17)	(*)	<90	120 Ω	246 (**)	19200 (***)	2, None (***)

Tab. 2.d

(*) With unshielded cable: Lmax = 10 m in residential/industrial environments and Lmax = 2 m in domestic applications.
(**) The maximum number of devices depends on the Client device used in the network and the use of signal amplifiers.
(***) Can be modified by parameter.

Caution: connect the shield to earth, do not connect to the GND on the controller. Connect a 120 Ω terminating resistor between the Tx/Rx+ and Tx/Rx- terminals on the last controller on the RS485 line; if a Boss supervisor is used, the line-start resistor is already built into the serial port, only the end-of-line terminating resistor must be connected.

2.10.1 Serial port configuration

The BMS port communication parameters can be set using parameters H0, H1 and H2. By default, MPXPRO leaves the factory with serial address 199, baud rate 19200 bit/s, 2 stop bits and no parity.

For the LAN port used for the main/secondary network, the settings are fixed (baud rate 19200 bit/s, 2 stop bits 2 and no parity).

The multifunction serial port is used on MPX controllers as BMS2 and its communication parameters can be configured using parameters H17, H18 and H19. By default, MPXPRO leaves the factory with serial address 199, baud rate 19200 bit/s, 2 stop bits and no parity also on the BMS2 port.

The BMS2_En parameter allows the BMS2 serial port to be disabled.

Code	Description	Def.	Min.	Max.	UOM	User	User terminal
H0	BMS serial address or main-secondary local network	199	1	247	-	S	YES
H1	BMS serial port configuration (stop bits and parity) 0 = 1 stop bit, no parity; 3 = 2 stop bits, even parity; 1 = 2 stop bits, no parity; 4 = 1 stop bit, odd parity; 2 = 1 stop bit, even parity; 5 = 2 stop bits, odd parity.	1	0	5	-	S	YES
H2	BMS serial port baud rate (bit/s): 0 = 1200; 3 = 9600; 6 = 57600; 1 = 2400; 4 = 19200; 7 = 115200. 2 = 4800; 5 = 38400;	4	0	7	-	S	YES
H17	BMS2 serial address	200	1	247	-	S	NO
H18	BMS2 serial port configuration (stop bits and parity) - see H1	1	0	5	-	S	NO
H19	BMS2 port baud rate (bit/s) - see H2	4	0	7	-	S	NO
BMS2_En	BMS2 serial port enable: 0 = disabled; 1 = enabled.	1	0	1	-	M	NO

Notice: for main/secondary configurations, the serial addresses of the secondary devices (H0) needs to be set consecutively to the main address.

Example: main address = 199 -> first secondary address = 200, second secondary address = 201, etc.

2.11 Connection diagram

The figure shows the MPXPRO controller general connection diagram

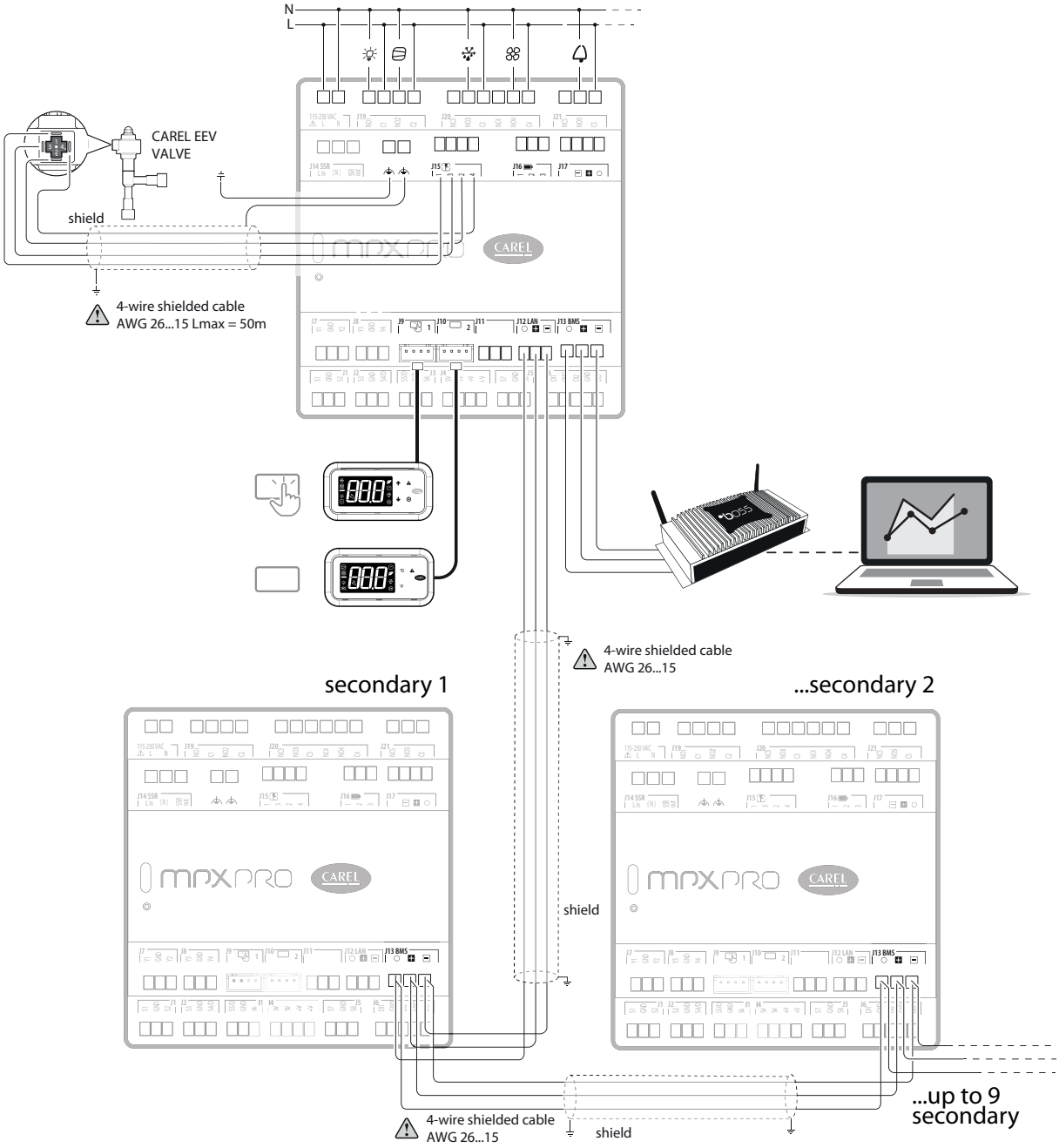


Fig. 2.aa

Caution: the connection to the USB-C port cannot be used to power external devices (e.g. smartphones), but rather only for commissioning from a PC.

Notice: the USB-C port can be disabled via the UsbMode parameter.

Code	Description	Def.	Min.	Max.	UOM	User	User terminal
UsbMode	USB-C port enable: 0 = disabled; 1 = enabled.	1	0	1	-	M	NO

2.12 Functional diagrams

MPXPRO can control multiple refrigeration 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 nine secondary controllers. The following functional diagrams illustrate some typical applications.

2.12.1 Stand-alone configuration

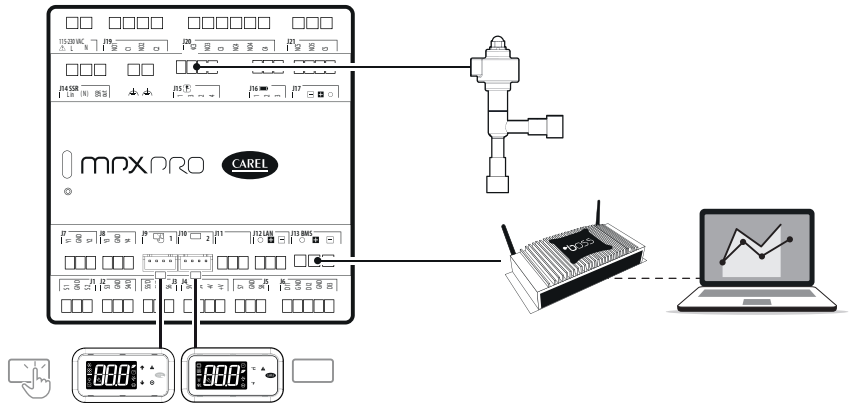


Fig. 2.ab

2.12.2 Main/secondary network

The main controller, connected to the supervision network, coordinates the functions of up to 9 secondary controllers connected via the RS485 Fieldbus.

⚠ **Caution:** for connection to a main/secondary network, the local subnet must be wired according to the following logic:

- main BMS (J13): connected to the supervisory system;
- main LAN (J12): connected to the BMS (J13) on the secondary devices.

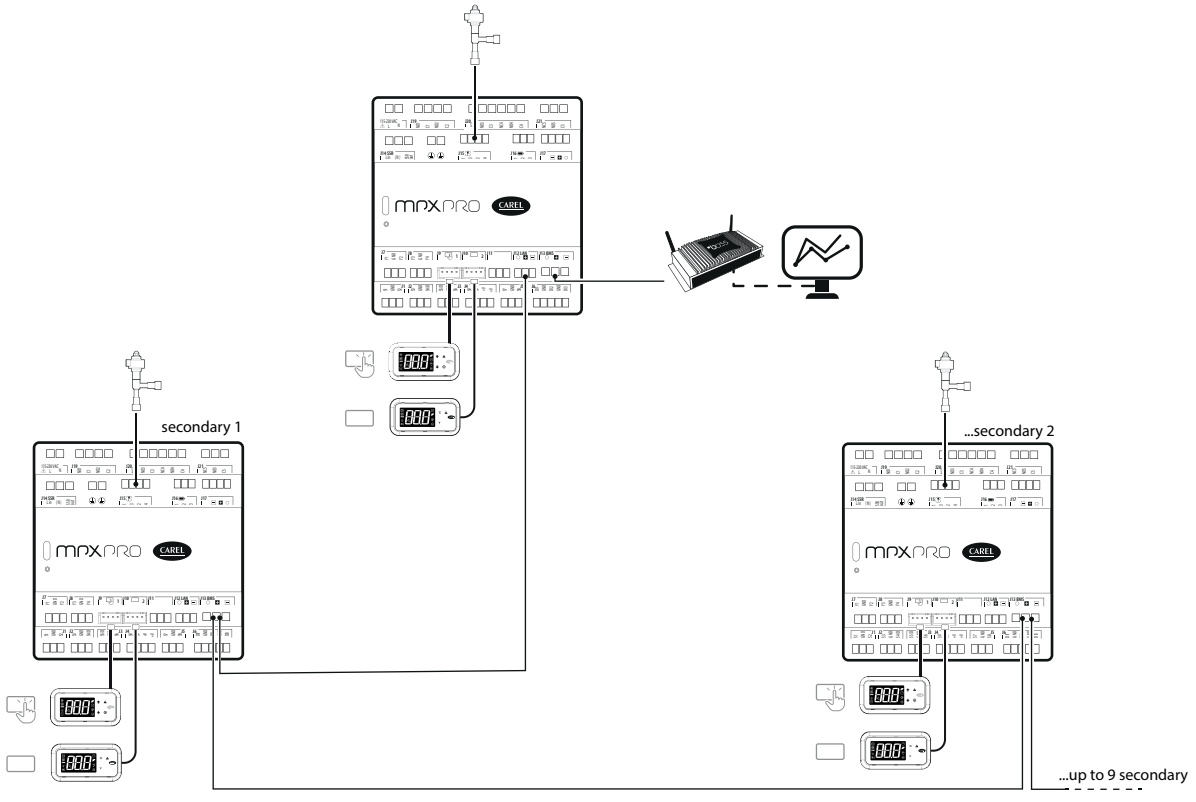


Fig. 2.ac

3. CONFIGURATION TOOLS

3.1 APPLICA app

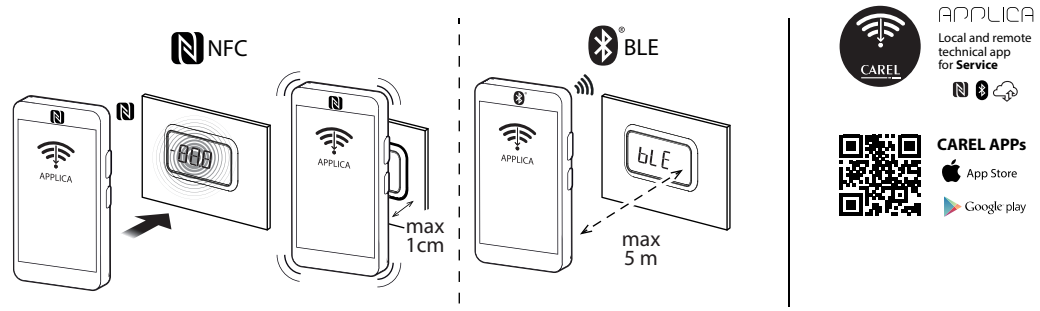


Fig. 3.a

The APPLICA app can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication) and Bluetooth® (BLE). Users can both configure the commissioning parameters and set groups of preset parameters according to specific needs (recipes). Supported devices: Android 7, iOS 11; Bluetooth® 4.0, and higher.

The APPLICA app can be downloaded from the Google Play Store or Apple Store. Once APPLICA has been installed and opened, proceed as follows:

- for NFC devices, move the mobile device near to the MPXPRO user terminal (the position of the NFC antenna on the mobile device must be identified in order to place it over the display): wait for the signal that the device has been read.
- for Bluetooth® devices, select the "SCAN BLUETOOTH" option, then choose the device from the list. When connecting for the first time, the device can be identified by the UID code shown on the product label; it can then be renamed once the connection has been established.

Access is possible through two user profiles, each with access to different sets of parameters (see the "Parameter Table" chapter):

- service (default password = 22);
- manufacturer (default password = 44).

Caution: It is strongly recommended to change the default password values during first commissioning.

Notice:

- make sure that the NFC or Bluetooth® antennas are enabled;
- some smartphones may experience malfunctions if GPS is not also activated;
- during Bluetooth® connection, the MPXPRO user terminal is disabled and shows "bLE".

3.1.1 APPLICA: save configuration

APPLICA can save the unit configuration and then apply it to other units.

Save configuration procedure:

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Service" or "Manufacturer" profile credentials;
3. select the "Save configuration" button at the top right;
4. press the red "Add configuration" button at the bottom right;
5. enter the configuration name, then click OK.

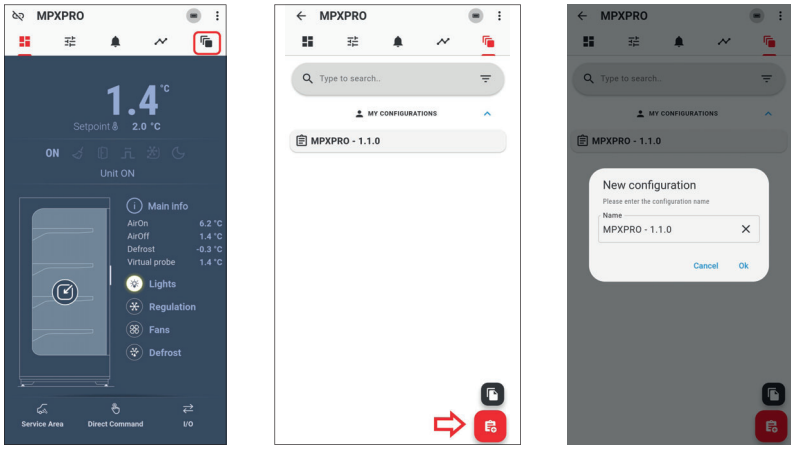


Fig. 3.b

3.1.2 APPLICA: import/export configuration

APPLICA can import and export previously saved configurations.

Import configuration procedure:

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Service" or "Manufacturer" profile credentials;
3. access the "Configurations" section from the hamburger menu or by following the path "Service area"-> "Setup menu"'-> "Configurations".

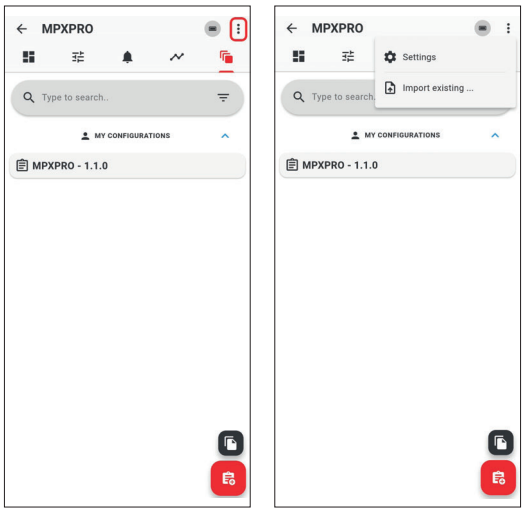


Fig. 3.c

4. click the toolbar menu button at the top right, then click "Import existing";
5. choose and select the configuration to be imported from the phone's file manager.

Export configuration procedure:

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Service" or "Manufacturer" profile credentials;
3. access to the "Configuration" section;
4. the previously saved configurations will be displayed, click the toolbar menu button for the configuration to be exported;
5. select the "Share configuration" button and choose how to share the configuration.

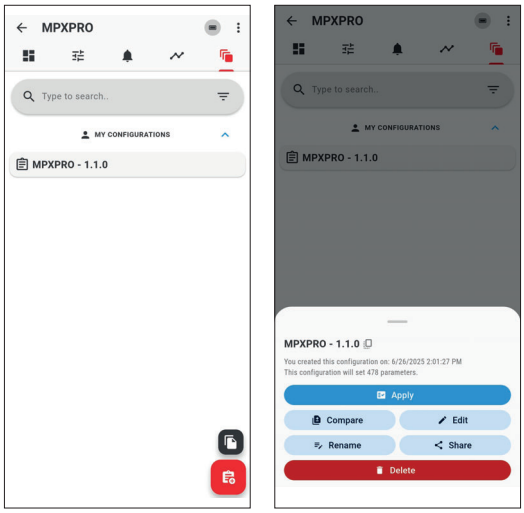


Fig. 3.d

3.1.3 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.

Cloned configuration creation procedure:

1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth®, entering the profile credentials;
3. follow the path "Service area"-> "Setup menu"-> "Clone";
4. enter the configuration name, then click OK.

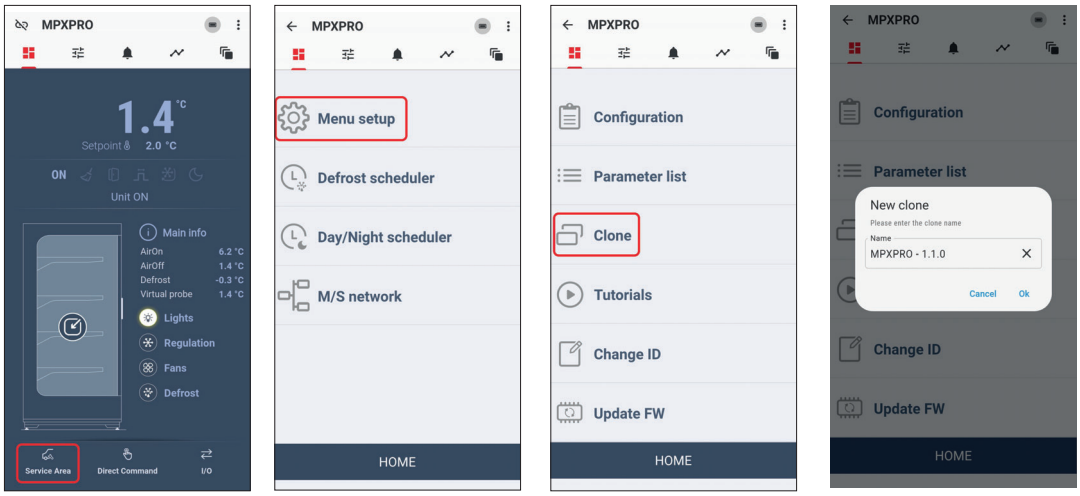


Fig. 3.e

Cloned configuration application procedure:

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Service" or "Manufacturer" profile credentials;
3. access the "Configurations" section from the hamburger menu or by following the path "Service area"-> "Setup menu"-> "Configurations";
4. select "'Clones" and choose the cloned configuration, then click OK;

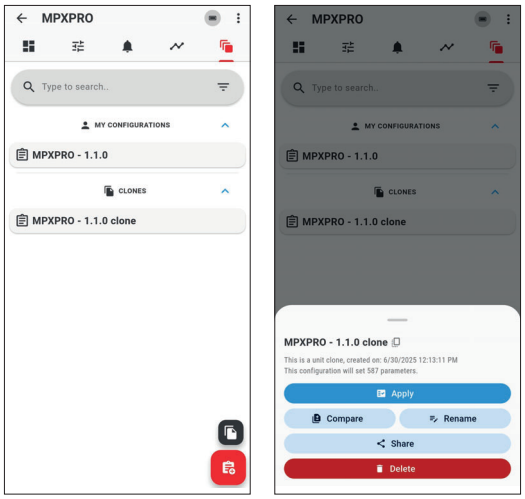


Fig. 3.f

5. for NFC connection only, move the device close to the MPXPRO to acquire the configuration from;
6. wait for the cloning confirmation message to be shown.

3.2 APPLICA Desktop

APPLICA Desktop is a program intended for manufacturers and installers of units fitted with the MPXPRO controller. It can be downloaded from ksa.carel.com. APPLICA Desktop offers the possibility to:

- access the controller using the assigned profile;
- create configurations;
- apply configurations;
- clone a unit configuration, i.e. copy all of the unit's parameter values;
- complete the commissioning procedure;
- troubleshoot any problems on the unit.

For the electrical connection, use the USB-C port on the controller (alternatively, connect to the BMS port using the USB/RS485 converter P/N CVSTDUMOR0).

Notice: APPLICA Desktop can be used as an alternative to the APPLICA app, and requires an internet connection.

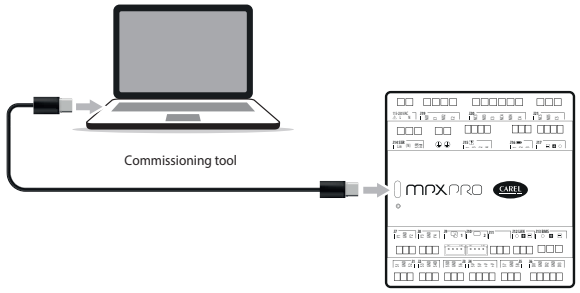


Fig. 3.g

Caution: the connection to the USB-C port cannot be used to power external devices (e.g. smartphones), but rather only for commissioning from a PC.

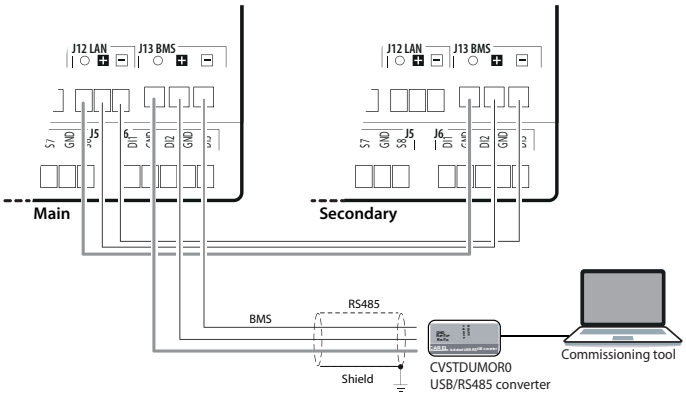


Fig. 3.h

3.3 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-C port on the controller (alternatively, connect to the BMS port using the USB/RS485 converter P/N CVSTDUMOR0).

Authorisation to use Spark under license is issued by CAREL.

3.4 Sparkly: command-line configuration and commissioning software

Sparkly is the command-line version of the configuration tool. It can be 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).

Contact CAREL for support.

4. USER INTERFACE

4.1 Introduction

The optional user terminal combines the display and the type A 4-button resistive or type B 3-button capacitive keypad. Pressing the buttons individually or in combination accesses the programming operations. The user interface display features three digits with sign and decimal point, a buzzer for signalling alarms and up to nine 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).

The user terminal can be used to display the alarms and the main unit values, set the parameters based on the access level, and check the status of the main actuators.

Code	Description	Def.	Min	Max	UoM	User	User terminal
PDM	Manufacturer password	44	0	999	-	M	NO
PDS	Service password	22	0	999	-	S	NO
PDU	User password	-	0	999	-	S	NO

The access levels are: U = User; S = Service; M = Manufacturer; The User, Service and Manufacturer passwords can be changed via the APPLICA app by modifying the corresponding parameters PDU, PDS and PDM, with up to 8 alphanumeric and special characters.

Caution: it is strongly recommended to change the default values of the passwords during commissioning.

The display's unit of measurement can be changed using parameter /5.

Code	Description	Def.	Min	Max	UoM	User	User terminal
/5	Unit of measure 0 = °C/barg, 1 = °F/psig	0	0	1	-	S	YES

The keypad and the buzzer can be disabled by setting parameters H6 and H8 respectively.

Code	Description	Def.	Min	Max	UoM	User	User terminal
H6	Enable keypad: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES
Hb	Buzzer: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES

NFC connectivity is managed via parameter H5. Due to its operating characteristics, the NFC memory is always active, even when the device is powered off. However, if H5 = 0, any writing to the NFC memory will be ignored by the controller..

Code	Description	Def.	Min	Max	UoM	User	User terminal
H5	Enable NFC connectivity: 0 = disabled; 1 = enabled.	1	0	1	-	S	NO

Bluetooth® connectivity is managed via parameter bte, which allows communication to be disabled, permanently enabled, or temporarily enabled following a command from the HMI terminal or the supervisor. The btc parameter allows a timeout to be set, after which communication is automatically disabled.

Code	Description	Def.	Min	Max	UoM	User	User terminal
btc	Timed Bluetooth® communication activation command (par. bto)	0	0	1	-	M	NO
bte	Bluetooth® communication activation mode: 0 = always off; 1 = always activated; 2 = activated by HMI or supervisor command (parameter btc) . 3 = activated by supervisor.	1	0	3	-	M	NO
bto	Bluetooth® communication activation time from HMI or supervisor command (par. btc)	120	0	999	min	M	NO

Notice: the user terminal gives access to a subset of parameters, while all parameters are visible via the Applica APP. Additionally, the information shown on the user terminal and within the Applica APP may vary depending on the profile used, the password entered, and the parameter configuration set by the manufacturer. See the Parameter Table for details.

4.2 User terminal and remote display

Type A, user terminal
4-button resistive

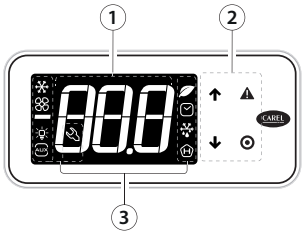


Fig. 4.i

Type B, user terminal
3-button capacitive

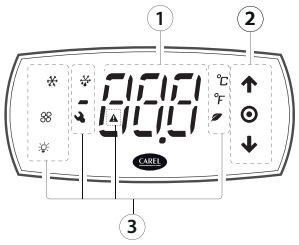


Fig. 4.j

Key:

1	Main field
2	Keypad
3	Icons

Remote display

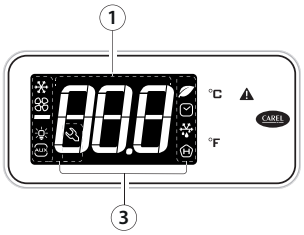


Fig. 4.k

XL remote display

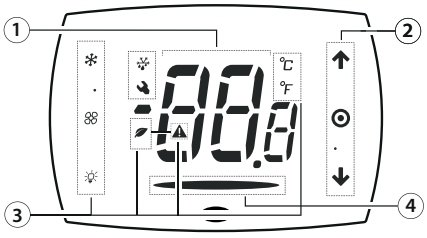


Fig. 4.l

Parameters /t1 and /t2 can be used to choose the variable shown on the display and on the remote terminal during normal operation, while parameter /t is used to enable alarm notifications on the remote display.
Furthermore, during defrosting, what is shown on the display and remote terminal can be set using parameter d6.
The decimal point can be disabled by setting a parameter (/6).

Code	Description	Def.	Min	Max	UoM	User	User terminal
/6	Display decimal point: 0 = Yes; 1 = No.	0	0	1	-	S	YES
/t	Display signals/alarms on remote display: 0 = disabled; 1 = enabled.	0	0	1	-	S	YES
/t1	Display on user terminal: 0 = terminal disabled; 1...8 = probe 1 to 8; 9 = control probe; 10 = virtual probe (Sv); 11...14 = serial probe 1 to 4; 15 = temp. set point; 16 = superheat.	9	0	16	-	S	YES
/t2	Display on remote display - see /t1	0	0	16	-	S	YES
d6	Display on terminal during defrost: 0 = temperature alternating with 'dEF'; 1 = freeze display; 2 = 'dEF'.	1	0	2	-	S	YES

4.2.1 Keypad

Tasto	Description	Function
	UP	LED on steady: • scroll direct access functions LED flashing: • scroll menus and parameters • increase value
	DOWN	LED on steady: • scroll direct access functions LED flashing: • scroll menus and parameters • decrease value
	Alarm (type A terminal only)	• Pressed briefly: display alarms and mute buzzer • pressed and held (3 s): reset alarms • LED on/flashing: acknowledged/active alarm
	PRG	Pressed briefly: • enter direct access function menu (from main screen) and activate/deactivate functions • during programming: save value and return to the parameter code Pressed and held (3 s): • Enter programming mode or return to previous level without saving

Tab. 4.a

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

4.2.2 Icons

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

Icon	Function	On	Flashing	Type A terminal / remote display	Type B terminal
	Solenoid/compressor	Solenoid/compressor active	Compressor timers active	●	●
	Evaporator fan	Evaporator fan on	-	●	●
	Lights	Light on	-	●	●
AUX	Auxiliary output	Auxiliary output active	-	●	-
	Clock	Scheduler active	-	●	-
	Energy saving	Smooth Lines active	-	●	-
	Defrost	Defrost active	Awaiting defrost	●	●
	Service	• Maintenance request • Setup wizard not completed		●	●
H	HACCP	HACCP active	-	●	-
+ AUX	Generic function	Generic function active	-	●	-
°C, °F	Unit of measure	Used unit of measure	-	● (remote display only)	●
	Alarms	Acknowledged alarms	Unacknowledged alarms	●	●

Tab. 4.b

4.2.3 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.

Notice: until the guided configuration wizard has been run at least once, after the firmware version the display shows the message "In" the service icon is on.

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:
- if no button is pressed, after around 20 seconds the terminal will automatically return to the standard display;
- the message "bLE" flashes during the Bluetooth® connection on the user terminal;
- during defrosting, the standard display depends on the setting of parameter d6;
- If there are active alarms, the standard display shows the main value alternating with the active alarm codes.

4.2.4 Direct commands

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

Icon	Display	On / Off
	Lht	Cabinet light
+ (flashing)	Cnt	Continuous cycle
	dEF	Defrost (local valves only, parameter r7 = 0, or electronic valve configured, parameter P1 ≠ 0)
	dFn	Network defrost (on main only, parameter In = 1 and with secondary connected, parameter Sn ≠ 0)
+ (flashing)	CLn	Clean cabinet
	ON	Unit ON
(*)	rES	Reset alarms
H + (flashing)	btc	Timed Bluetooth® communication activation (only with timed Bluetooth® activation enabled, parameter bte =2, 3)

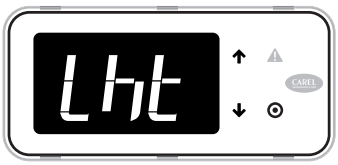
Tab. 4.c

(*) the ALARM button only switches off if there are no more active alarms.

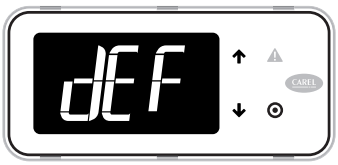
To access the direct commands, use the following buttons:
- from standard display: PRG to enter the direct commands menu;
- UP and DOWN to scroll through the commands;
- PRG to activate/deactivate the commands;
- select the ESC menu item to exit the direct commands menu.

Procedure: example of direct defrost activation

1. Go to the standard display



2. Press PRG to enter the direct commands menu: the first command is shown - Lht (light) - and the UP and DOWN buttons come on



3. Press UP or DOWN to scroll through the commands until dEF (defrost) is shown.

4. Press PRG to change the status of the displayed function, the corresponding icon switches on/off to indicate the status of the function

5. Press UP or DOWN to scroll through the commands and, if necessary, repeat point 4 to activate/deactivate other functions, or scroll to ESC and press PRG to exit.

6. The standard display is shown

4.2.5 Programming mode

The user terminal provides access to the basic configuration parameters, such as direct functions and active alarms without password protection, or, with password protection, unit set-up.

The controller can be programmed in two levels, with access to different parameters based on the password entered (see the parameter table):
- Service (default password = 22);
- Manufacturer (default password = 44).

The User profile does not need a password and has reduced parameter access.

Caution: it is strongly recommended to change the default password values during the first commissioning.

To navigate the menu tree, use the following buttons:
- from standard display: PRG (3s) to enter the password;
- 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.

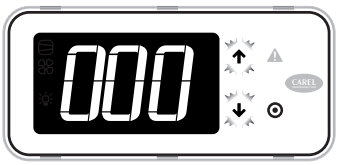
Notice: for easier programming, use the APPLICA app.

In main/secondary networks, the parameters of the secondary controllers can also be accessed via the user terminal connected to the main controller, simply by selecting the "SEC" menu item and entering the number of the desired secondary unit. To return to the main controller, switch back to the standard display mode and re-enter programming mode.

Procedure: example of how to modify parameter St (set point)

1. Wait for the standard display to be shown

2. Press PRG for 3 s: the password prompt is displayed (PSd)



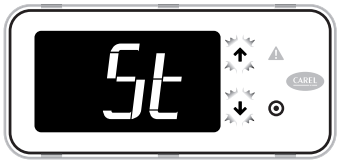
3. Press PRG: UP and DOWN flash

4. Press UP/DOWN and enter the password for the desired profile

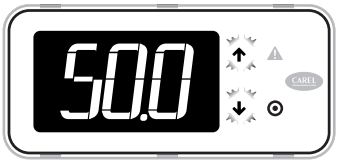
5. Press PRG: if the password is correct, the first parameter category is shown

Notice: if the password is incorrect, the standard display is shown again, and the procedure needs to be repeated from point 1

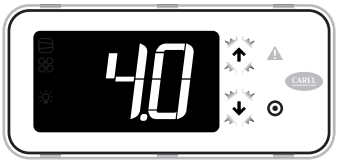
6. Press UP/DOWN until displaying the CtL (= Control) parameter category



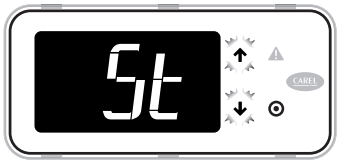
7. Press UP/DOWN until displaying parameter St (= set point)



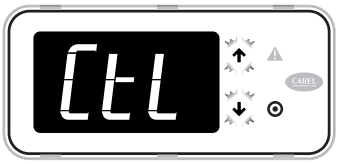
8. Press PRG to display the parameter value



9. Press UP/DOWN to modify the value



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



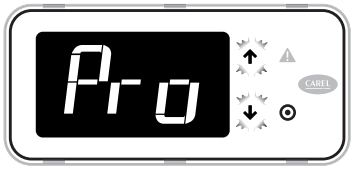
11. Press PRG for 3 seconds or alternatively, in the parameter level press ESC and press PRG to return to the parameter categories If necessary, repeat steps 6...9 to configure other parameters

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

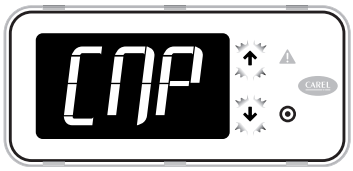
4.2.6 Programming menu

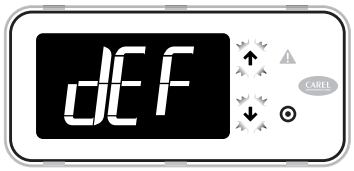
Menu item	Parameters available
SEC - SECONDARY 	Scn ESC

Menu item	Parameters available
VIS - DISPLAY 	Sm, Sd, Sr, SA, SU, Svt, SH, PPu, tGS, tEu, PEu (all read-only) ESC

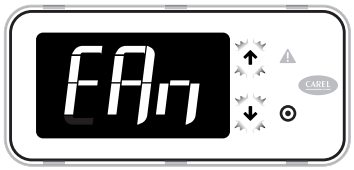
Menu item	Parameters available
PRO - PROBES 	/2, /3, /4, /5, /6, /CA, /cb, /cc, /cd, /cE, /cF, /cG, /cH, /cl, /cL, /cM, /cn, /co, /FA, /FAF, /FAG, /Fb, /Fc, /Fd, /FE, /FG, /FH, /FI, /FL, /FM, /Fn, /Fo, /LA, /LE, /LL, /P1, /P2, /P3,/P4, /P5, /t, /t1, /t2, /UA, /UE, /UL, rHS ESC

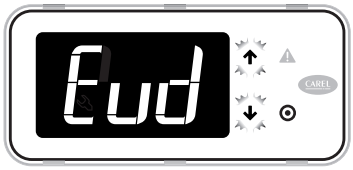
Menu item	Parameters available
Ctl - CONTROL 	**Clt**, ON, **r1**, **r2**, **r3**, **r4**, **r6**, **r7**, rd, **rd2**, ro, St, **St2**, **Stt**, ESC

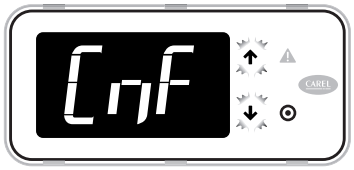
Menu item	Parameters available
CMP - COMPRESSOR 	**c0**, **c1**, **c2**, **c3**, **c4**, **c6**, **c7**, **cc** ESC

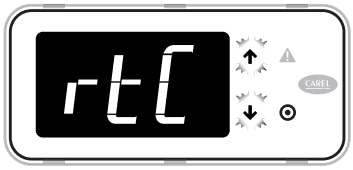
Menu item	Parameters available
dEF - DEFROST 	d0, d10, d11, d12, d1S, d2, d2S, d3, d4, d5, d6, d7, d8, d9, dd, ddP, ddt, dH1, dHG, dl, dn, dP1, dP2, **dS1**, **dS2**, dSb, dt1 dt2 ESC

Menu item	Parameters available
ALr - ALARMS 	A0, A1, A11, A2, A6, A9, AA, **AA2**, Ad, Ad2, Add, AH, AH2, AHA, AL, AL2, ALA, ESC

Menu item	Parameters available
FAN - FANS 	F0, F1, F10, F2, F3, F5, F6, F7, F8, Fd, Frd ESC

Menu item	Parameters available
EVD - EV Driver 	cP1, **P1**, P10, P11, **P12**, **P14**, P15, P3, **P4**, **P5**, **P6**, P7, **P8**, **P9**, **Pdd**, **PH**, **PHS**, PL1, PL2, PL3, **PLt**, PM1, **PM2**, **PM3**, PM5, PMP, PMu, Po6, PSb, **PSd**, **PSI**, **PSM**, **PSP** ESC

Menu item	Parameters available
CnF - CONFIGURATION 	dIt, H0, H1, H14, H2, H6, **H8**, Hb, In, POM, rHA, rHb, rHd, rHo, rHt, rHu, Sn ESC

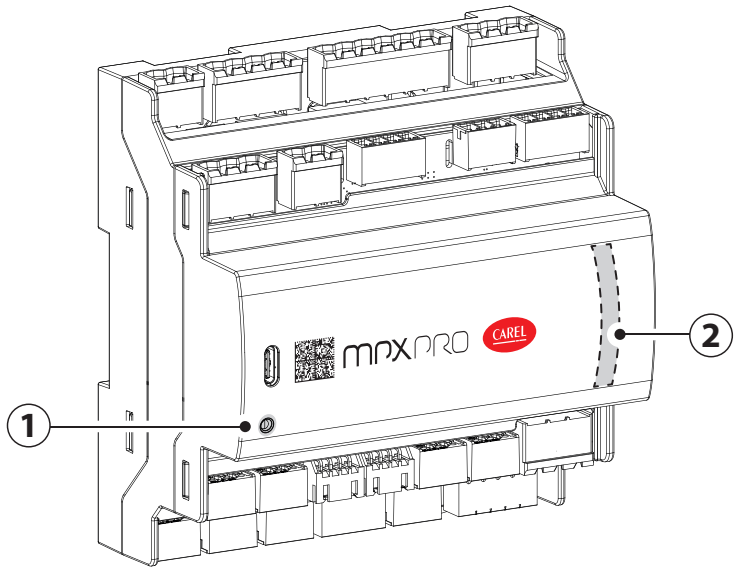
Menu item	Parameters available
rtC - DATE/TIME 	d__, h__, M__, m__, y__, ESC

Menu item	Parameters available
Vcc - VCC 	/P6, /P7, cMi, CMA, Cnf, CMf, cSc, CdF, cct ESC

Menu item	Parameters available
ESC 	ESC (return to standard display)

Notice: the parameters shown in bold are only accessible from the Manufacturer profile. The visibility of all the parameters can be linked to other control settings, see the parameter table for details.

4.3 Minimal interface



Key:

1	Button
2	LED

Fig. 4.m

The MPXPRO controller has a minimal interface, with one multi-colour LED and one button; this provides basic information on the operation of the controller if no external HMI is connected.

During startup or firmware update, the RGB LED turns **yellow**, with meanings as described in the corresponding table.

Yellow LED	Description
ON steady	Boot startup
On with short off pulses	OS startup
Slow blinking	Default application running
Off with short on pulses	Update preparation
Fast blinking	Update in progress

Caution: if the yellow LED remains stuck in any of the above states, contact CAREL technical support.

During normal application operation, two RGB LED modes are available:
- main display mode;
- communication diagnostics.

By default, the LED comes on steady or flashes to indicate the operating status, as shown in the following table.

Colour	On steady	Flashing
White	Control in progress	Slow blinking: control active but waiting for configuration wizard (see "First start-up" chapter)
Green	Clean mode active	-
Red	Acknowledged alarms present	Fast blinking: active alarms not yet acknowledged
Cyan	Defrost in progress	Slow blinking: defrost pending execution
Magenta	Control in OFF status (not due to alarm)	-

Pressing the button briefly with a pointed object accesses the menu level to display the communication status; pressing it again repeatedly cycles through the status information listed in the table.

Colour	On steady	Flashing
Magenta	Communication with BMS normal operation	Fast blinking: communication with BMS interrupted
Cyan	On main controller, communication with secondary normal operation	Fast blinking: communication with secondary interrupted on main controller

After 15 seconds of inactivity, the LED returns to default mode and displays the status as shown above.

5. 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 initial configuration parameters and where necessary the date/time. The parameters can be set on a smartphone (via APPLICA app), using configuration software (APPLICA desktop, Spark, Sparkly) or from the user terminal.
The parameters used for commissioning are shown in the Parameter table.

Caution: 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.

MPXPRO features highly configurable inputs and outputs. CAREL recommends using a configuration that follows the default settings for all the parameters; in this way, the controller can manage the main functions autonomously in most applications, without needing to make major changes to the parameter configuration.

5.1 Via smartphone

5.1.1 APPLICA: configuration wizard

When first started, MPXPRO runs a procedure (configuration wizard) that requires the settings of the critical parameters, relating to:

- correct configuration of the probe types;
- correct communication of the controller with the supervisor and the main/secondary network;
- electronic valve management.

Notice: during this procedure, the device remains in standby and all of its functions are deactivated (including control and communication via RS485).

Procedure

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Service" or "Manufacturer" profile credentials;
3. If the unit has not yet been configured, when connecting to the controller from a mobile device, the "Wizard" procedure will begin;
4. complete the unit configuration by pressing the PREV / NEXT buttons to scroll through all of the configuration parameter pages;
5. with an NFC connection, move the device near to the user terminal to write the copied values.

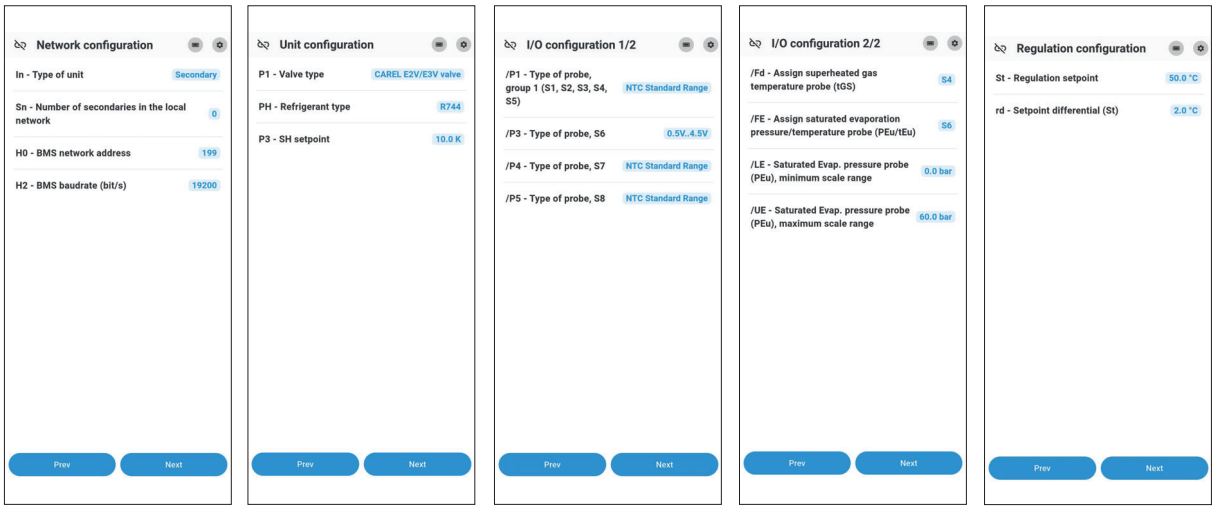


Fig. 5.a

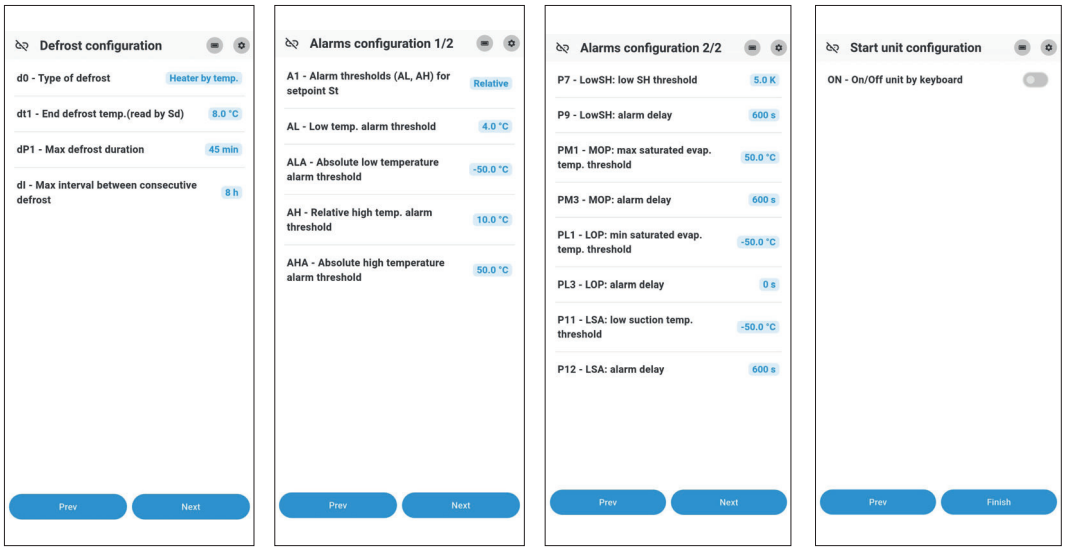


Fig. 5.b

6. apply the parameters configured via NFC / Bluetooth® to the controller.

Notice: for NFC connection only, at the end of the procedure the mobile device will need to be moved closer to the controller in order to save the parameter configuration.

5.1.2 APPLICA: date and time setting

APPLICA has a feature for setting the date/time on MPXPRO in just one simple step, copying the values from the mobile device.

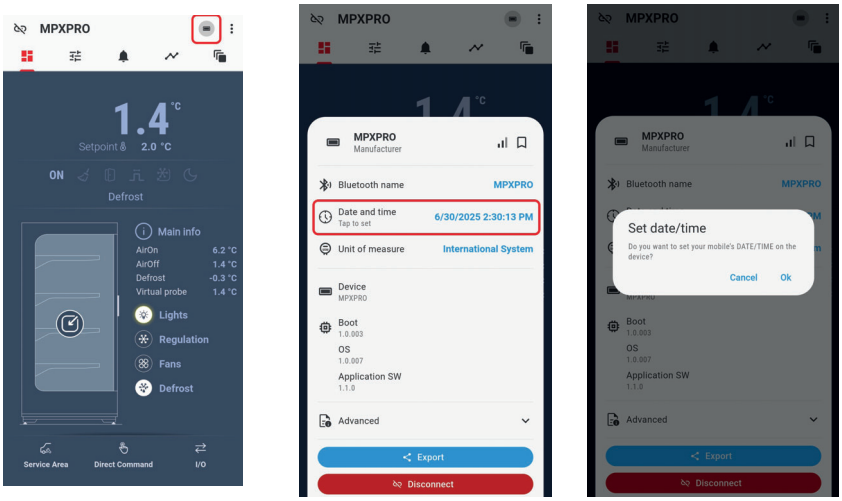


Fig. 5.c

Procedure:

1. open APPLICA on the mobile device;
2. access the controller via NFC or Bluetooth®, entering your profile credentials;
3. access the hamburger menu on the command bar at the top left;
4. select "Set date/time";
5. confirm;
6. with an NFC connection, move the device near to the user terminal to write the copied values.

Notice: with a Bluetooth® connection, the values are copied on confirmation.

5.1.3 Applica: time band settings

Applica makes it easy to set the controller day/night time bands.

Procedure:

1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth®, entering your profile credentials;
3. follow the path "Service area"-> "Setup menu"-> "Day/Night scheduler";
4. define the day/night time bands for each day of the week by either clicking the required time band or setting the corresponding parameters;

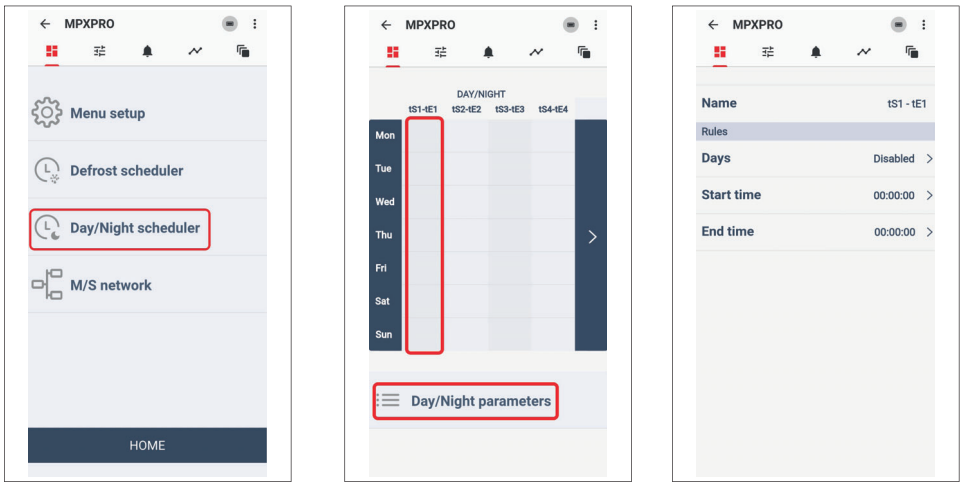


Fig. 5.d

5. apply the defined time bands to the controller (for NFC connection only, use the upload button at the top right).

Notice: eight daily time bands can be configured by setting parameters S1, tE1…tS8, tE8.

A similar procedure can be used to set scheduled defrosts, following the path "Service area"-> "Setup menu"-> "Defrost scheduler".

5.2 Via PC (USB-C/serial) with configuration tool

5.2.1 APPLICA Desktop: commissioning

1. Connect to the controller's USB-C port or BMS port, as shown in "APPLICA desktop";
2. start APPLICA Desktop; a window opens as shown in the figure;

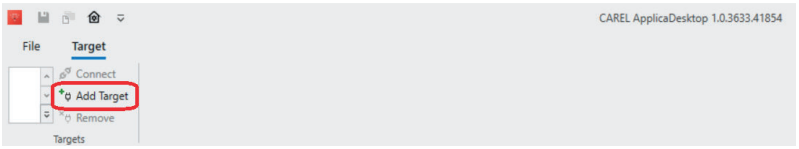


Fig. 5.e

3. Select "Add target" and assign it a meaningful name (e.g. "MPXPRO");
4. specify the COM port used for the connection in the "COM Port" field. The COM port depends on the USB port used; to find it, click on "Windows Tools", "Device Manager", then "COM port";
5. configure the connection parameters (Baud rate = any (e.g. 19200), Bits=8, Parity=None, Stop Bits=Two, Serial Node=248) as shown in the figure (the data are saved automatically);
6. select "Connect" to connect to the MPXPRO (which must be powered on);
7. enter your profile credentials;
8. set the commissioning parameters.

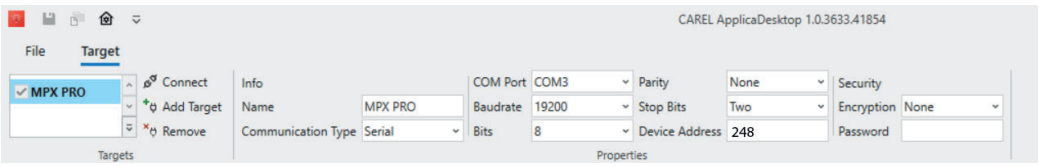


Fig. 5.f

Notice: once the controller has been configured, set parameter WD to "TRUE" to prevent the Wizard procedure from restarting when the device is powered on again.

5.2.2 APPLICA Desktop: date and time setting

APPLICA Desktop can set the date and time on MPXPRO in just one simple step, copying the values from the PC to the controller.

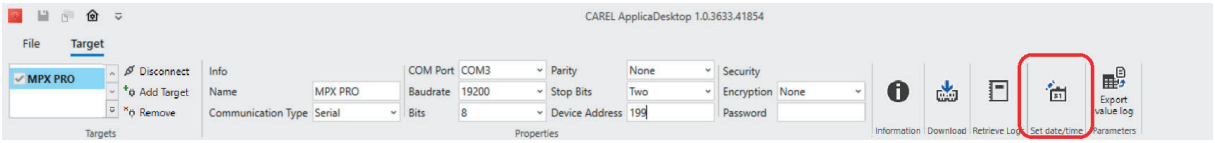


Fig. 5.g

Procedure:

1. Once connected, select "Set date&time";
2. in the pop-up window, confirm synchronisation of the time and date on MPXPRO with the PC.

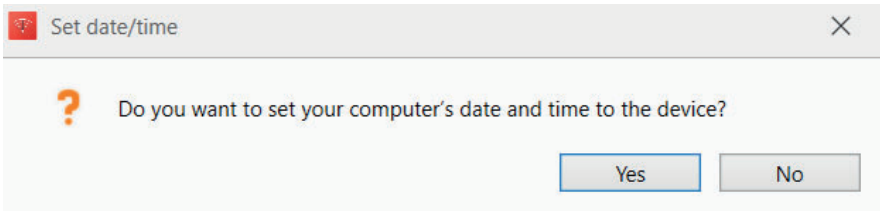


Fig. 5.h

5.3 Via user terminal

When first started, MPXPRO runs a procedure (configuration wizard) that requires the settings of the critical parameters, relating to:

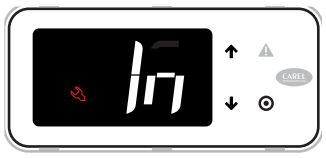
- correct configuration of the probe types;
- correct communication of the controller with the supervisor and the main/secondary network;
- electronic valve management.

Notice: during the wizard, the red Service icon comes on if the value of the parameter shown on the display has not yet been displayed. The procedure cannot be completed unless all the parameters have been displayed at least once.

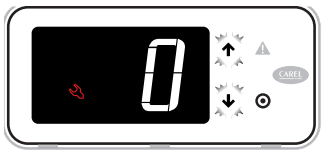
During this procedure, the device remains in standby and all of its functions are deactivated (including control and communication via RS485).

Caution: at the end of the wizard, the controller operates with the default parameters; specifically, it will be in ON status but with the set point at the default value of 50°C, and therefore control will not be active.

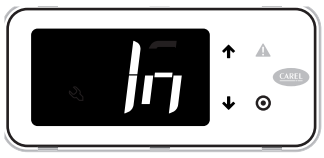
Procedure:



1. power on the controller and wait for the display to show the first parameter In (unit type);
2. press PRG to enable parameter settings, the arrows flash;



3. press UP/DOWN to modify the value;



4. press PRG to save the value (the red Service icon will go off);

5. press UP/DOWN to go to the next parameter;
6. repeat points 2 to 5 for all commissioning parameters;

7. once all the parameters have been configured (Service icon off), pressing PRG on the ESC screen completed the configuration wizard;

8. wait for the standard display to be shown.

5.4 Initial configuration parameters

Below are the main commissioning parameters available in the wizard procedure via the user terminal and the APPLICA app. The parameters shown for the APPLICA app can be used as a reference for first commissioning via commissioning tools (APPLICA Desktop, Spark, Sparkly), although in this case a more detailed configuration is possible, as all parameters are accessible according to the credentials used.

Par.	Description	Display	APPLICA
In	Type of unit: 0 = secondary; 1 = main.	●	●
Sn	Number of secondary devices in the local network	●	●
H0	BMS serial or main-secondary local network address	●	●
H2	BMS serial port baud rate (bit/s)	●	●
P1	Electronic valve type	●	●
PH	Type of refrigerant used in the unit	●	●
P3	Superheat set point	●	●
/P1	Type of probe, group 1 (S1, S2, S3, S4, S5)	●	●
/P3	Type of probe S6 (*)	●	●
/P4	Type of probe S7 (*)	●	●
/P5	Type of probe S8 (*)	●	●
/Fd	Assign superheated gas temperature probe (tGS) (*)	●	●
/FE	Assign saturated evaporation pressure/temperature probe (PEu/tEu) For the secondary, if /FE = 0 the value is shared with the main. (*)	●	●
/LE	Minimum value for saturated evaporation pressure/temperature probe (PEu/tEu) (*)	●	●
/UE	Maximum value for saturated evaporation pressure/temperature probe (PEu/tEu) (*)	●	●
St	Set point	●	●
rd	Differential	-	●
d0	Type of defrost	-	●
dt1	End defrost temperature (read by Sd)	-	●
dP1	Maximum defrost duration	-	●
dI	Maximum interval between consecutive defrosts	-	●
dd	Dripping time (fans off) after defrost (0 = no dripping)	-	●
Fd	Post-dripping time after defrost (fans off with control active)	-	●
A1	Alarm thresholds relative to the set point St (AL, AH) or absolute (ALA, AHA)	-	●
AL	Relative low temperature alarm threshold	-	●
ALA	Absolute low temperature alarm threshold	-	●
AH	Relative high temperature alarm threshold	-	●
AHA	Absolute high temperature alarm threshold	-	●
P7	LowSH, low superheat threshold	-	●
P9	LowSH, alarm delay (0 = alarm disabled)	-	●
PM1	MOP, max saturated evaporation temperature threshold	-	●
PM3	MOP, alarm delay (0 = alarm disabled)	-	●
PL1	LOP, minimum saturated evaporation temperature threshold	-	●
PL3	LOP, alarm delay (0 = alarm disabled)	-	●
P11	LSA, low suction temperature threshold	-	●
P12	LSA, alarm delay (0 = alarm disabled)	-	●
ON	Unit On/Off command from user terminal: 0 = OFF; 1 = ON.	●	●

(*) visible only with electronic valve configured (parameter P1 = 1 or P1 = 2).

Tab. 5.a

5.4.1 Description of the initial configuration parameters

In: type of unit

Parameter In defines the controller as main or secondary.

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

Parameter Sn sets the number of secondary controllers that the main controller manages in the local network; if Sn = 0, the main is a stand-alone unit. The maximum number of secondary controllers in a subnet is 9. On secondary controllers, the parameter must be left at 0 (during the Wizard procedure, the parameter is not visible if In = 0)

Code	Description	Def	Min	Max	UOM	User	User terminal
Sn	Number of secondary devices in the local network	0	0	9	-	S	YES

H0: serial or main/secondary network address

Parameter H0 sets the address the control responds to on the BMS port, i.e. the address of the main controller in the supervisory network, or the address of the secondary in the LAN network. The address of the secondary controllers must follow the rule below, where n is the secondary number from 1 to 9 (see example).

$$H0_{Secondary} = H0_{Main} + n$$

Code	Description	Def	Min	Max	UOM	User	User terminal
H0	BMS serial or main-secondary local network address	199	1	247	-	S	YES

Caution: 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.

Notice:
- Secondary addresses must be consecutive;
- only the main controller needs to be connected to the RS485 serial line (connector J13 BMS), all of the secondary controllers communicate with the supervisor via the main, connected to the main's RS485 Fieldbus port (connector J5 FBus). 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.

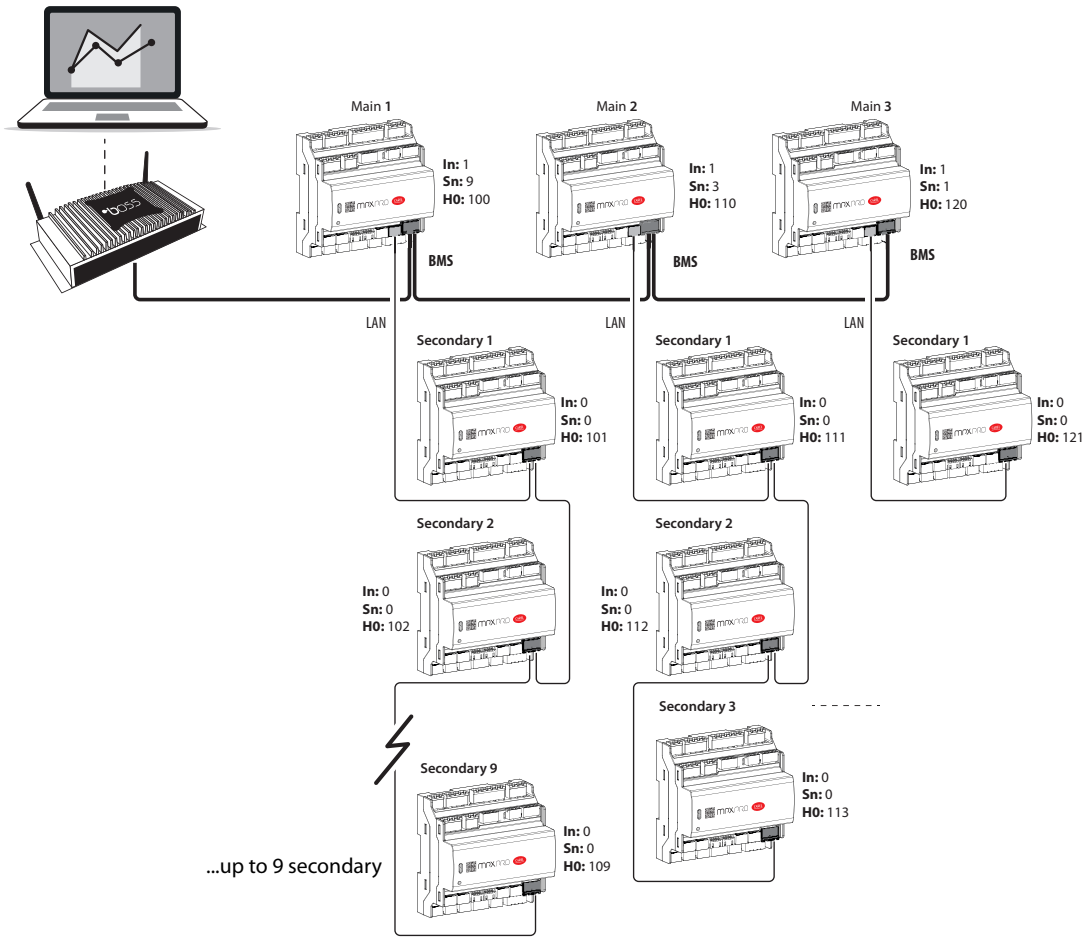


Fig. 5.i

Notice: MPXPRO is compatible with Modbus® supervisory networks.

/P1: type of probe, group 1 (S1, S2, S3, S4, S5)
Parameter /P1 selects the type of temperature probe for inputs S1, S2, S3, S4 and S5.

Code	Description	Def	Min	Max	UOM	User	User terminal
/P1	Type of probe, group 1 (S1, S2, S3, S4, S5): 0 = PT1000; 1 = NTC; 2...4 = reserved; 5 = NTC-HT.	1	0	5	-	S	YES

Notice: if used as analogue inputs, S1, S2, S3, S4/D, and S5/D must all be of the same type.

P1: type of electronic expansion valve

Parameter P1 selects the type of electronic expansion valve used for superheat control.

Code	Description	Def	Min	Max	UOM	User	User terminal
P1	Electronic valve type: 0 = not used/thermostatic valve; 1 = PWM valve (connected to terminal J14 SSR); 2 = Carel bipolar valve E2V, E3V (connected to terminal J15); 3 = 0-10V modulation for refrigerant flow control 4 = PWM valve modulation for refrigerant flow control 5 = Carel E2V/E3V valve modulation for refrigerant flow control 7 = valve modulation 8 = 0-10 V modulation	2	0	6	-	M	YES

Notice: PWM valves can be used by connecting them directly to the controller (SSR terminal J14); these do not require the use of a solid state relay between the controller and the valve.

PH: type of refrigerant

Parameter PH selects the type of refrigerant used in the unit.
Setting the refrigerant type is essential for calculating superheat and saturated evaporation and condensation temperatures based on pressure probe measurements.

Code	Description	Def	Min	Max	UOM	User	User terminal
PH	Type of refrigerant used in the unit:	11	0	47	-	M	YES

0: Custom	10: R717	20: R427A	30: R170	40: R454B
1: R22	11: R744	21: R245Fa	31: R442A	41: R458A
2: R134a	12: R728	22: R407F	32: R447A	42: R407H
3: R404A	13: R1270	23: R32	33: R448A	43: R454A
4: R407C	14: R417A	24: HTR01	34: R449A	44: R454C
5: R410A	15: R422D	25: HTR02	35: R450A	45: R470A
6: R507A	16: R413A	26: R23	36: R452A	46: R515B
7: R290	17: R422A	27: HFO1234yf	37: R508B	47: R466A
8: R600	18: R423A	28: HFO1234ze	38: R452B	
9: R600a	19: R407A	29: R455A	39: R513A	

/P2: group 1 inputs used as digital inputs

Parameter /P2 selects how many inputs in group 1 are used as digital inputs and not as probes.

Code	Description	Def	Min	Max	UOM	User	User terminal
/P2	Group 1 inputs used as digital inputs: 0= none; 1 = S4/D; 2 = S4/D e S5/D.	0	0	2	-	S	YES

/P3, /P4, /P5: probe type S6, S7, S8

Parameters /P3, /P4 and /P5 select the type of probe used for inputs S6, S7, S8.

Code	Description	Def	Min	Max	UOM	User	User terminal
/P3	Type of probe S6: 0 = PT1000 Standard Range 1 = NTC Standard Range 2 = Reserved 3 = 4-20 mA 4 = 0-10V 5 = NTC-HT 6 = 0.5 V-4.5 V	6	0	6	-	S	YES
/P4	Type of probe S7 - see /P3	1	0	6	-	S	YES
/P5	Type of probe S8 - see /P3	1	0	6	-	S	YES

/Fd: assign superheated gas temperature probe (tGS)

Parameter /Fd parameter is used to assign the probe for measuring the superheated gas temperature leaving the evaporator (tGS).

Code	Description	Def	Min	Max	UOM	User	User terminal
/Fd	Assign superheated gas temperature probe (tGS) 0 =function disabled; 1 = probe S1; 2 = probe S2; 3 = probe S3; 4 = probe S4; 5 = probe S5; 6 = probe S6; 7 = probe S7; 8 = probe S8; -1 = serial probe 11; -2 = serial probe 12; -3 = serial probe 13; -4 = serial probe 14.	4	-4	8	-	S	YES

/FE: assign saturated evaporation pressure/temperature probe (PEu/tEu)

Parameter /FE is used to assign the probe used for measuring the evaporation pressure (PEu). The evaporation pressure measurement is used by the MPXPRO controller to calculate the saturated evaporation temperature (tEu).
It is recommended to connect a Carel standard 0.5...4.5 V ratiometric probe to input S6.

Code	Description	Def	Min	Max	UOM	User	User terminal
/FE	Assign saturated evaporation pressure/temperature probe (PEu/tEu) - see /FA. For the secondary, if /FE = 0 the value is shared with the main.	6	-4	8	-	S	SI

/UE, /LE: maximum/minimum value of probe PEu

Parameters /UE and /LE are used to define the maximum and minimum limits of the range of measurement for probe PEu.

Code	Description	Def	Min	Max	UOM	User	User terminal
/LE	Minimum value for saturated evaporation pressure/temperature probe (PEu/tEu)	0	-1/ -14.5	/UE	barg/ psig	S	YES
/UE	Maximum value for saturated evaporation pressure/temperature probe (PEu/tEu)	60/ 870.2	/LE	200/ 2900.7 (*)	barg/ psig	S	YES

(*) these values may not be displayed correctly on the 7-segment display, as the display limits are -999/999.

St: control set point

parameter St sets the cabinet temperature control set point.

Code	Description	Def	Min	Max	UOM	User	User terminal
St	Set point	50/ 122	r1	r2	°C/°F	S	YES

rd: differential

the rd parameter allows setting the control differential of the cabinet temperature.

Code	Description	Def	Min	Max	UOM	User	User terminal
rd	Differential	2/ 3.6	0.1	99.9/ 179.8	Δ °C/°F	S	YES

d0: type of defrost:

the d0 parameter allows choosing the unit's defrost type either by heater or hot gas, and either temperature- or time-terminated.

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; 5 = hot gas by temperature; 6 = hot gas by time.	0	0	4	-	S	YES

dt1: end defrost temperature

The dt1 parameter sets the temperature threshold to be reached to end defrost.

Code	Description	Def	Min	Max	UOM	User	User terminal
dt1	End defrost temperature (read by Sd)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES

dP1: maximum defrost duration

The dP1 parameter sets the duration of defrost when time-terminated or the maximum duration before triggering alarm Ed1 if temperature-terminated.

Code	Description	Def	Min	Max	UOM	User	User terminal
dP1	Maximum defrost duration	45	1	240	min	S	YES

dI: maximum interval between defrosts

The dI parameter sets the maximum safety interval between defrosts.

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

dd: dripping time

The dd parameter sets the post-defrost drip time, during which fans and control remain off.

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

Fd: post-dripping time

The Fd parameter sets the post-dripping duration, with fans off and temperature control active.

Code	Description	Def	Min	Max	UOM	User	User terminal
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	YES

A1: temperature alarm threshold

Selects whether high/low temperature alarms are relative to the set point or absolute.

Code	Description	Def	Min	Max	UOM	User	User terminal
A1	Alarm thresholds relative to the set point St (AL, AH) or absolute (ALA, AHA): 0 = relative; 1 = absolute.	0	0	1	-	S	YES

AL: relative low temperature alarm threshold

The AL parameter sets the threshold relative to the set point for triggering a low temperature alarm. The alarm is activated when the temperature drops below the value St – AL (see the "Alarms" chapter).

Code	Description	Def	Min	Max	UOM	User	User terminal
AL	Relative low temperature alarm threshold	4/ 7.2	0	50/ 90	Δ °C/°F	S	YES

ALA: absolute low temperature alarm threshold

Using parameter ALA, the absolute threshold for the low temperature alarm can be set. The alarm is triggered when the temperature drops below the ALA value (see the 'Alarms' chapter).

Code	Description	Def	Min	Max	UOM	User	User terminal
ALA	Absolute low temperature alarm threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES

AH: relative high temperature alarm threshold

Using parameter AH, the threshold relative to the set point for the high temperature alarm can be set. The alarm is triggered when the temperature rises above the value St+AH (see the 'Alarms' chapter).

Code	Description	Def	Min	Max	UOM	User	User terminal
AH	Relative high temperature alarm threshold	10/ 18	0	50/ 90	Δ °C/°F	S	YES

AHA: absolute high temperature alarm threshold

Using parameter AHA, the absolute threshold for the high temperature alarm can be set. The alarm will be triggered when the temperature rises above the AHA value (see the 'Alarms' chapter).

Code	Description	Def	Min	Max	UOM	User	User terminal
AHA	Absolute high temperature alarm threshold	50/ 122	-50/ -58	200/ 392	°C/°F	S	YES

P7: low superheat alarm threshold

Using parameter P7, the threshold for the low superheat alarm (LowSH) can be set.

Code	Description	Def	Min	Max	UOM	User	User terminal
P7	LowSH, low superheat threshold	5	-10	P3	K	S	YES

P9: low superheat alarm delay

Using parameter P9, the delay time for the low superheat alarm (LowSH) can be set. If P9 = 0, the alarm is disabled.

Code	Description	Def	Min	Max	UOM	User	User terminal
P9	LowSH, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES

PM1: maximum saturated evaporation temperature protection threshold (MOP)

Using parameter PM1, the intervention threshold for maximum saturated evaporation temperature protection (MOP) can be set.

Code	Description	Def	Min	Max	UOM	User	User terminal
PM1	MOP, max saturated evaporation temperature threshold	50/ 122	-50/ -58	50/ 122	°C/°F	S	YES

PM3: maximum saturated evaporation temperature protection delay (MOP)

Using parameter PM3, the delay time for maximum saturated evaporation temperature protection (MOP) can be set. If PM3 = 0, the protection is disabled.

Code	Description	Def	Min	Max	UOM	User	User terminal
PM3	MOP, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES

PL1: minimum saturated evaporation temperature protection threshold (LOP)

Using parameter PL1, the intervention threshold for minimum saturated evaporation temperature protection (LOP) can be set.

Code	Description	Def	Min	Max	UOM	User	User terminal
PL1	LOP, minimum saturated evaporation temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES

PL3: minimum saturated evaporation temperature protection delay (LOP)

Using parameter PL3, the delay time for minimum saturated evaporation temperature protection (LOP) can be set. If PL3 = 0, the protection is disabled.

Code	Description	Def	Min	Max	UOM	User	User terminal
PL3	LOP, alarm delay (0 = alarm disabled)	0	0	240	s	S	YES

P11: low suction temperature protection threshold (LSA)

Using parameter P11, the intervention threshold for low suction temperature protection (LSA) can be set.

Code	Description	Def	Min	Max	UOM	User	User terminal
P11	LSA, low suction temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES

P12: low suction temperature protection delay (LSA)

Using parameter P12, the delay time for low suction temperature protection (LSA) can be set. If P12 = 0, the protection is disabled.

Code	Description	Def	Min	Max	UOM	User	User terminal
P12	LSA, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES

ON: unit On/Off control from user interface

Using parameter ON, the unit can be switched on. At the end of the wizard procedure, the unit will be ready to start control.

Code	Description	Def	Min	Max	UOM	User	User terminal
ON	Unit On/Off command: 0 = OFF; 1 = ON.	0	0	1	-	S	NO

5.5 Setting the default parameters/loading the parameter sets

When MPXPRO is first powered on, the default parameters are loaded into the controller's memory; following this, either the configuration wizard needs to be run or a configuration loaded. The parameters modified in this way represent the working set that is loaded at each subsequent power on, allowing the unit to function correctly. The set of working parameters can be changed at any time from the user terminal, supervisor, APPLICA app or other configuration tools.

On the controller, in addition to the default parameters, two other sets of parameters defined by Carel are available; these can be loaded via digital input or user interface. These parameter sets can only be modified using the Spark configuration tool.

Notice: to save and apply other custom parameter configurations, use the configuration tools described under "Configuration tools".

5.5.1 Reset default settings procedure

The factory reset procedure is available from the user terminal, the APPLICA app, or configuration tools.

Procedure from user terminal:

1. power down the controller;
2. press PRG;
3. power on the controller again while holding PRG: at the end, the number 0 is displayed, which signifies the parameters have been reset to the default values;
4. press PRG;
5. power the controller off and on again;
6. complete the wizard (see "Commissioning").

Procedure from APPLICA App:

1. launch the APPLICA app on the mobile device;
2. access the controller via NFC or Bluetooth®, using the "Manufacturer" profile credentials;
3. go to the "Parameters" section;
4. set parameter rSC to 1;
5. with NFC connection, bring the mobile device close to the user terminal to write the set value.

Caution: resetting the parameters to the factory default values is irreversible and overwrites any parameters set by the user. It is recommended to save the controller's configuration before resetting (see "Configuration tool").

5.5.2 Loading preset parameter sets

Procedure:

1. disconnect power from the controller;
2. press the PRG button;
3. restore power to the controller while keeping the PRG button pressed until the number 0 appears on the display;
4. press UP/DOWN to select the parameter set (from 1 to 6) to be loaded as the working set and confirm with PRG;
5. power off and on the controller again;
6. if required, run the guided first commissioning procedure (see the chapter "Commissioning").

Caution: loading a preset parameter set is an irreversible operation that overwrites all working parameters previously set by the user. It is recommended to save the current configuration to the controller before proceeding (see the chapter "Configuration tools").

Notice: preset parameter sets stored on the controller can only be modified using the Spark configuration tool.

5.6 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 and remote display;
- 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.

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

6. FUNCTIONS

A detailed parameter configuration can be set in order to optimise the features of MPXPRO, as described in the following paragraphs. Parameter configuration can be performed via the HMI interface, configuration software or APPLICA app.

Caution: 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".

6.1 Inputs and outputs

MPXPRO has a maximum of 6 analogue inputs, 3 digital inputs and 2 multifunction inputs. As regards the outputs, there are 4 analogue outputs, 5 or 6 relays depending on the model, and 1 SSR output. For details, see the description of the terminals under "Description of the terminals".

6.1.1 Probes (analogue inputs)

The NTC and PT1000 temperature probes, 0,4...4.5 V ratiometric and 4...20 mA and 0...10 V active, connectable to the analogue inputs, are divided into groups; the type of probe must be the same for each group.

Notice: inputs S4 and S5 can also be configured as digital inputs.

Analogue input	S1	S2	S3	S4	S5	S6	S7	S8
Parameter for type of probe			/P1			/P3	/P4	/P5
0 = PT1000 standard –60T120 °C	●	●	●	●	●	●	●	●
1 = NTC standard –50T90 °C	●	●	●	●	●	●	●	●
2 = not available	-	-	-	-	-	-	-	-
3 = 4...20 mA	-	-	-	-	-	●	●	●
4 = 0...10 V	-	-	-	-	-	●	●	●
5 = NTC - HT 0-150°C	●	●	●	●	●	●	●	●
6 = 0.5-4.5 V	-	-	-	-	-	●	●	●
7 = digital input	-	-	-	(*)	(*)	-	-	-

Tab. 6.a

(*) Selectable via parameter /P2.

Caution: for the maximum current supplied to ratiometric and active probes, see "Technical specifications".

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

Probe	Par.
Outlet temperature (Sm)	/FA
Defrost temperature (Sd)	/Fb
Intake temperature (Sr)	/Fc
Intake temperature 2 (Sr2)	/Fc2
Superheated gas temperature (tGS)	/Fd
Saturated evaporation pressure/temperature (PEu/tEu)	/FE
Auxiliary defrost temperature probe (Sd2)	/FF
Auxiliary temperature 1 (Saux)	/FG

Probe	Par.
Auxiliary temperature 2 (Saux2)	/FH
Ambient temperature (SA)	/FI
Ambient humidity (SU)	/FL
Glass temperature (Svt)	/FM
Dew point temperature (SdP)	/Fn
Condensing temperature (Sc)	/Fo
Auxiliary pressure (SPaux)	/FAF
Auxiliary pressure 2 (SPaux2)	/FAG

Tab. 6.b

0.5 - 4.5V pressure transducers (standard CAREL ratiometric probes) or active probes with 4-20 mA or 0-10 V outputs can be connected to inputs S6, S7 and S8. These require the definition of the range of measurement by setting the parameters relating to the minimum /LA, ..., /LL and maximum values /UA, ..., /UL for the function associated with the probe. See the parameter table.

Notice: only for analogue inputs is it possible to assign different functions to the same physical channel, e.g., /Fb = 2 and /Fd = 2. For all other inputs/outputs, assigning multiple functions to the same channel will cause a configuration error, signalled by alarms CfA, CfD, or CfO, and only one of the configured inputs/outputs will operate.

Shared probe

It is possible to share just one pressure probe across the main-secondary network, physically connected to the main. The probe must be configured on the main using parameters /FE, /UE and /LE; on the secondary controllers, set /FE = 0 (function disabled) to activate sharing of the value read on the main. In this way, the secondary devices automatically search for the pressure value shared by the main and used for calculating the local superheat. This is used to save on the installation costs of a pressure probe for each evaporator, assuming that the pressure drop in that section of the line is negligible.
In addition to the pressure probe, temperature and ambient humidity probes as well as the dew point value can also be shared over the main–secondary LAN network, when connected to the main. This can be achieved by correctly configuring the probes using parameters /FI, /FL, /Fn, /UL, and /LL, and setting the corresponding /FI, /FL, /Fn = 0 on the secondary units (function disabled). In this way, the secondary units automatically retrieve the values shared by the main and use them to calculate the glass temperature and dew point.

Probe positioning and configuration

See "Introduction" for the probe part numbers.

Notice:

- the glass temperature probe must be connected to the coldest point of the showcase glass, for optimum operation of the anti-sweat device (heaters or fans). See technical leaflet +050002005;
- for more information see the technical leaflets, downloadable, even prior to purchase, from www.carel.com

The temperature and humidity probes must be positioned not too far from the cabinets being monitored. At times it is better to install more than one if the supermarket is divided into sections with greatly differing temperature and humidity values (frozen section, meat section, fruit and vegetable section, etc.)

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

Code	Description	Def	Min	Max	UOM	User	User terminal
/FA	Assign outlet temperature probe (Sm): 0 = function disabled; 1 = S1 probe; 2 = S2 probe; 3 = S3 probe; 4 = S4 probe; 5 = S5 probe; 6 = S6 probe; 7 = S7 probe; 8 = S8 probe; -1 = 11 serial probe; -2 = 12 serial probe; -3 = 13 serial probe; -4 = 14 serial probe.	1	-4	8	-	S	YES
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	8	-	S	YES
/Fc	Assign intake temperature probe (Sr) - see /FA	3	-4	8	-	S	YES

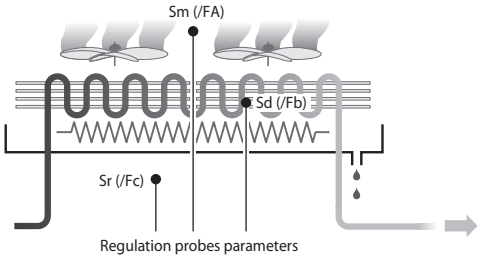


Fig. 6.a

MPXPRO, 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 MPXPRO the default settings can be changed to choose the function associated with any of the probes connected. There are cases where application characteristics require different settings, see the parameters table.

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. The function shares the main device's 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 MPXPRO 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 controller 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 in the status found prior to the instant it is activated, i.e. it 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 secondary controllers follow this based on their compressor management times. Otherwise, the user terminal is managed if the secondary controller goes into duty setting mode due to no communication with the main; the secondary activates the corresponding icon on the user interface when it is in duty setting mode due to no communication with the main;
- 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, ... /co)

MPXPRO features 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. Parameter /cE, on the other hand, corrects the value of the saturated evaporation temperature calculated directly based on the evaporation pressure.

HACCP, caution: 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.

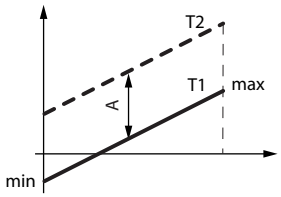


Fig. 6.b

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. 6.c

Code	Description	Def	Min	Max	UOM	User	User terminal
/cA	Outlet temperature probe (Sm) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cb	Defrost temperature probe (Sd) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cc	Intake temperature probe (Sr) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES

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

/2: analogue probe measurement stability

Code	Description	Def	Min	Max	UOM	User	User terminal
/2	Analogue probe measurement stability (filter): 1= probe reading not delayed; ... 15= maximum probe reading delay	9	1	15	-	S	YES

The /2 parameter defines the coefficient used to stabilize probe measurements. Low values assigned to this parameter allow a faster response of the probe to changes in the measured variable; however, the reading becomes more sensitive to noise. Higher values slow down the response but ensure greater noise immunity, resulting in a more stable, precise, and filtered reading.

/3: display probe value

Code	Description	Def	Min	Max	UOM	User	User terminal
/3	Display probe value: 0 = disabled; 1 = fast update; ... 15 = slow update.	0	0	15	-	S	YES

The /3 parameter defines the coefficient used for displaying probe readings. Low values assigned to this parameter allow the user interface to respond quickly to changes in the measured variable. The responsiveness of the display does not affect control performance.

6.1.2 Digital inputs

MPXPRO manages up to 5 physical digital inputs 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 stop 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
Enable alternative superheat set point	DIs	Inactive	Active
Enabling alternative superheat set point - see DIA	DIV	Not active	Active
Low pressure switch	DIZ	Active	Not active

Tab. 6.d

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	User	User terminal
rIA, rIb, ...,rIv	Immediate alarm digital input logic: 0 = NC; 1 = NO.	0	0	1	-	S	NO

Notice: reversing the logic has no effect on the virtual DI.

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	Selection of digital input propagated from main to secondary (only on main): -1 = from supervisor; 0 = disabled; 1 = digital input 1 (DI1); 2 = digital input 2 (DI2); 3 = digital input 3 (DI3); 4 = digital input 4 (S4/D); 5 = digital input 5 (S5/D).	0	-1	5	-	S	YES

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.

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. Hb);
- 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	Assign digital input for immediate external alarm: -1 = serial digital input; 0 = function disabled; 34 = digital input 4 (S4/D); 35 = digital input 5 (S5/D); 39 = digital input 1 (ID1); 40 = digital input 2 (ID2); 41 = digital input 3 (ID3).	0	-1	41	-	S	NO

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	41	-	S	NO

Enable defrost (par. DIc)

This function can be useful to prevent unit defrosts from occurring at undesired times, as it allows disabling any defrost request. When the contact is open, all defrost requests are ignored.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIc	Assign enable defrost digital input - see DIA	0	-1	41	-	S	NO

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).

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.

Code	Description	Def	Min	Max	UOM	User	User terminal
d5	Defrost delay at power on or (for secondary) after control from main	0	0	240	min	S	YES
DId	Assign start defrost digital input - see DIA	0	-1	41	-	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 switch-off (see paragraph DOE) with delay configurable via parameter 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
Ad	Delay time for high and low temperature alarms (AH/AHA, AL/ALA)	120	0	240	min	S	YES
Add	High temperature alarm bypass time for door open	30	1	240	min	S	NO
DIE	Assign digital input for door contact with solenoid/compressor and evaporator fans OFF - see DIA	0	-1	41	-	S	NO
DOE	Assign light digital output - see DOA	1	0	6/7	-	S	NO
H14	Time light stays on after closing the door	0	0	240	min	S	YES
Tdoor	Door open: alarm delay	30	1	240	min	S	NO

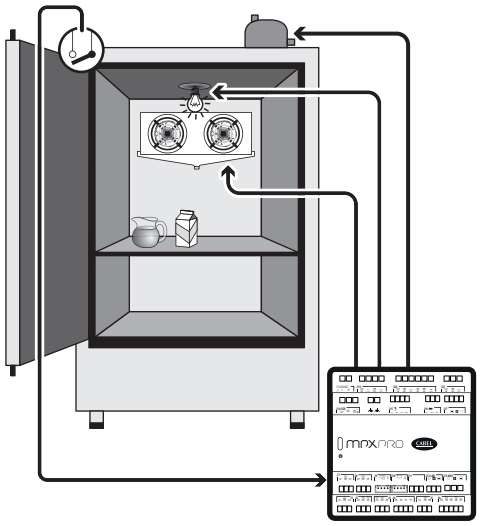


Fig. 6.c

Caution: 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 with threshold AH/AHA (threshold relative to set point/absolute) 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
c0	Delay to enable solenoid/compressor and evaporator fans at power on	0	0	240	min	M	YES
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	YES
DIF	Assign remote ON/OFF digital input - see DIA	0	-1	41	-	S	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 H8.

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 H8.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIG	Assign curtain contact digital input - see DIA	0	-1	41	-	S	NO
H8	Output switched with time bands: 0 = light; 1 = auxiliary output	0	0	1	-	S	NO
r4	Automatic night set point variation	0	-50/ -90	50/ 90	Δ °C/°F	M	YES
r6	Probe for night-time control: 0 = virtual probe (Sv); 1 = intake probe (Sr).	0	0	1	-	M	YES

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
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	YES
cc	Running time in continuous cycle (0 = function disabled)	0	0	15	hours	M	YES
DIH	Assign start/stop continuous cycle digital input - see DIA	0	-1	41	-	S	NO

Digital input monitoring (par. DII)

It is possible to monitor the status of a digital input configured via parameter DII.

Code	Description	Def	Min	Max	UOM	User	User terminal
DII	Assign status monitoring digital input - see DIA	0	-1	41	-	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	41	-	S	NO
dIt	Timer duration for timed digital input (0 = function disabled)	0	0	999	min	S	YES
DOo	Assign timed digital output - see DOA	0	0	6/7	-	S	NO

When a digital input configured as a timed digital input detects a transition from inactive to active state, the "Timer" variable visible to the supervisor is set to ON and remains ON, independently of the physical state of the digital input, for a time defined by parameter dIt. Setting parameter dIt to 0 disables the function.

The timed digital input can be controlled not only via the physical digital input but also by the supervisor through the appropriate digital control variable, with the same effect. Using this same control, it is also possible to force the "Timer" variable to OFF, regardless of whether the time set by parameter dIt has elapsed.

Notice: when the Timer variable is ON, a new OFF-to-ON transition of the digital input will restart the dIt timer.

By properly configuring the related parameter DOo, it is possible to link the Timer variable to a digital output (relay), which will operate consistently with the state of the variable.

Switch to standby status (par. DIM)

Standby is an intermediate status between ON and OFF: control is paused, the expansion valve is closed (0%), and lights, fans, and control alarms are either active or inactive according to the value of parameter SBM. Sensor-related alarms remain active. Standby status ends when timer Stt elapses, after a shutdown (OFF), or when the controller is restarted.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIM	Assign digital input for switching to standby mode - see DIA	0	-1	41	-	S	NO
SBM	Output activation during standby status: 0 = independent lights, fans OFF, control alarms ON; 1 = lights OFF, fans ON, control alarms OFF.	0	0	1	-	M	YES
Stt	Maximum time for standby status	0	0	240	min	M	YES

Switch to clean status (par. DIn)

The Clean state is an intermediate state between ON and OFF: control is paused, the expansion valve is closed (0%), lights are kept either active or inactive according to the value of parameter CLM, fans are turned off, and only sensor failure alarms remain active. The Clean state ends upon expiration of the CLt timer, after a shutdown (OFF state), or when the controller is restarted.

Code	Description	Def	Min	Max	UOM	User	User terminal
CLM	Output activation during Clean state: 0 = independent lights, fans OFF, control alarms OFF; 1 = lights OFF, fans OFF, control alarms OFF.	0	0	1	-	M	YES
CLt	Max time for clean status	0	0	999	min	M	YES
DIn	Assign digital input for switching to clean mode - see DIA	0	-1	41	-	S	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	Depend on par. SBM	Depend on par. CLM
Fans	Disabled	Enabled	Depend on par. SBM	Disabled
Defrost	Disabled	Enabled	Disabled	Disabled
Probe alarms	Enabled	Enabled	Enabled	Enabled
Other alarms	Disabled	Enabled	Depend on par. SBM	Disabled
User terminal	OFF	Depend on par. /t1	Stb	CLn

Tab. 6.e

Change working set (par. DIo)

This digital input can be used to perform a parameter set change by selecting between the first two configurations loaded in the controller: configuration 1 (digital input inactive) and configuration 2 (digital input active). The parameter change occurs on the input state transition.

Caution: when changing sets, the default parameters for the chosen configuration are loaded into the memory, 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	41	-	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 contact without control stop digital input - see DIA	0	-1	41	-	S	NO

Defrost start/stop via digital input (see parameter 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	41	-	S	NO
dP1	Maximum defrost duration	45	1	240	min	S	YES
r3	End defrost signal by timeout: 0 = disabled; 1 = enabled.	0	0	1	-	M	YES

Digital input; generic alarm (par. DIs)

When this digital input closes, the generic alarm is triggered and the message "GHI" appears on the display. For details, see the "Generic alarm" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIs	Assign digital input for generic alarm function - see DIA	0	-1	41	-	S	NO

Activation of alternative superheat set point (see parameter DIV)

This digital input allows modifying the superheat set point value. When the digital input is active, the superheat set point and the low superheat alarm threshold assume the values set via parameters P3A and P7d, respectively.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIV	Assign digital input for enabling alternative superheat set point - see DIA	0	-1	41	-	S	NO
P3A	Very Low Superheat, default superheat set point	5	0	25	K	S	NO
P7d	Very Low Superheat, alternative low superheat alarm threshold	5	-10	P3	K	S	NO

Low pressure switch (see parameter DIZ)

The low pressure switch is used to perform a pump-down with pressure-based termination (see parameter C10), in order to empty the evaporator before a defrost cycle, and to signal a low-pressure alarm during normal operation.

If, during the pump-down, the low pressure switch changes state again and restart during pump-down is enabled via parameter C9 = 1, the procedure ends and the "Ats" alarm (restart during pump-down) is triggered. See the "Defrost" paragraph and the chapter "Notifications and Alarms" for further details.

Code	Description	Def	Min	Max	UOM	User	User terminal
C9	Enable solenoid/compressor autostart during pump down: 0 = disabled; 1 = enabled.	0	0	1	-	M	NO
C10	Type of end pump down: 0 = pressure; 1 = time (par. cPt).	0	0	1	-	S	NO
DIZ	Assign low pressure switch digital input - see DIA	0	-1	41	-	S	NO
dH1	Pump down duration (0 = pump down disabled)	0	0	999	s	S	YES

6.1.3 Analogue outputs

MPXPRO features four analogue outputs, Y1...Y4, configurable as 0–10 V, PWM at 100 Hz, PWM at 2 kHz, or frequency modulation (set via parameter). Analog outputs configured in frequency modulation can be used as control signals for managing variable-capacity compressors. Y1 and Y2 can also be used to emulate a digital PWM signal with a "long" period (in seconds) for controlling loads such as PWM valves or anti-fog resistors; in this case, a solid state relay (SSR) must be connected.

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); 3 = analogue output 3 (Y3); 4 = analogue output 4 (Y4);	0	0	4	-	S	NO
/Ab	Assign analogue output for modulating valve - see /AA	0	0	4	-	S	NO
/Ac	Assign analogue output for modulating anti-sweat heaters - see /AA	0	0	4	-	S	NO
/Ad	Assign analogue output for generic modulating function - see /AA	0	0	4	-	S	NO
/AE	Assign analogue output for modulating condenser fans - see /AA	0	0	4	-	S	NO
/AG	Assign analogue output for modulating compressor - see /AA	0	0	4	-	S	NO
/P6	Type of analogue output 1 (Y1): 0 = 0-10 V; 1 = PWM 100 Hz; 2 = PWM 2 kHz; 3 = frequency modulation.	0	0	3	-	S	YES
/P7	Type of analogue output 2 (Y2) - see /P6	0	0	3	-	S	YES
/P8	Type of analogue output 3 (Y3) - see /P6	0	0	3	-	S	YES
/P9	Type of analogue output 4 (Y4) - see /P6	0	0	3	-	S	YES

6.1.4 Digital outputs

Depending on the model, MPXPRO can have 5 or 6 digital outputs NO1...NO6 and one SSR output. To assign each available function to a digital output, parameters DOA, DOb, … DOq must be configured with the value corresponding to the physical digital output. See the parameter table for details.

Digital output functions

Digital output assignment for:	Par.	Default
Solenoid/compressor	DOA	Digital output 2 (NO2)
Hot gas valve	DOAA	-
Max. fans speed	DOAM	-
Min. fans speed	DOAN	-
Alarm	DOb	Digital output 5 (NO5)
Auxiliary output	DOc	-
Auxiliary output serving the main on the secondary devices	DOd	-
Light	DOE	Digital output 1 (NO1)
Light serving the main on the secondary devices	DOF	-
Defrost	DOG	Digital output 3 (NO3)
Auxiliary evaporator defrost	DOH	-
Hot gas valve equalisation output	DOHE	
Evaporator fans	DOI	Digital output 4 (NO4)
Auxiliary compressor	DOk	-
Liquid valve	DOn	-
Output associated with the timer function	DOo	-
Condensate drain heater	DOP	-
Anti-sweat heater	DOQ	-
Generic On/Off function (stage)	DOS	-
Condenser fans	DOt	-

Tab. 6.f

Parameters rOb, ..., rOt can be used to reverse the logic of the functions associated with the digital inputs.

Code	Description	Def	Min	Max	UOM	User	User terminal
rOA, ..., rOt	Solenoid/compressor digital output logic: 0 =NO; 1 = NC.	0	0	1	-	S	NO

Solenoid/compressor (par. DOA)

Used to activate the compressor or use the liquid solenoid valve in applications with a thermostatic expansion valve

Code	Description	Def	Min	Max	UOM	User	User terminal
DOA	Assign solenoid/compressor digital output: 0 = function disabled; 1 = digital output 1 (NO1); 2 = digital output 2 (NO2); 3 = digital output 3 (NO3); 4 = digital output 4 (NO4); 5 = digital output 5 (NO5); 6 = digital output 6 (NO6/SSR); 7 = digital output 7 (SSR), only for models with 6 relays. **Note:** for SSR outputs, check the actual availability in the model used	2	0	6/7	-	S	NO

Hot gas valve (param. DOAA)

Parameter DOAA allows selecting the digital output for the hot gas valve. See the "Defrost" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOAA	Assign digital output for hot gas defrost - see DOA	0	0	6/7	-	S	NO

Maximum fan speed (param. DOAM)

Parameter DOAM allows selecting the digital output for controlling the evaporator fans at maximum speed.
See the "Evaporator fans" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOAM	Assign digital output for maximum fan speed - see DOA	0	0	6/7	-	S	NO

Minimum fan speed (param. DOAN)

Parameter DOAN allows selecting the digital output for controlling the evaporator fans at minimum speed.
See the "Evaporator fans" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOAN	Assign digital output for minimum fan speed - see DOA	4	0	6/ 7	-	S	NO

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 normally energised (rOb = 1) 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	5	0	6/7	-	S	NO
rOb	Alarm digital output logic - see rOA	0	0	1	-	S	NO

Auxiliary output (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 H8).

Code	Description	Def	Min	Max	UOM	User	User terminal
DOc	Assign auxiliary digital output - see DOA	0	0	6/7	-	S	NO
H8	Output switched with time bands: 0 = light; 1 = auxiliary output.	0	0	1	-	S	NO
tS1..8-d	Start time band 1 to 8 - day: 0 = event disabled; 1 to 7 = Monday to Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
tS1..8-time	Start time band 1 to 8 - time (only for App APPLICA)	00:00:00	00:00:00	23:59:59	time	S	NO
tE1..8-d	End time band 1 to 8 - day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-time	End time band 1 to 8 - time (only for App APPLICA)	00:00:00	00:00:00	23:59:59	time	S	NO

Auxiliary serving the main on the secondary devices (par. DOd)

The action on the auxiliary output is propagated via LAN from the main to the secondary units where the auxiliary output is configured as dependent on the main via parameter DOd. Therefore, this output follows the behaviour of the main's auxiliary output. The switching on/off of the output is accompanied by the switching on/off of the AUX icon on the HMI terminal on the secondary, where present.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOd	Assign digital output for auxiliary output serving the main on secondary devices - see DOA	0	0	6/7	-	S	NO

Light (param. DOE)

The light can be switched on/off directly from the HMI terminal via direct functions, from the Applica App, by supervisor command, or through day/night status transitions (linked to the curtain/door switch or to the time band settings). The switching on/off of the light is accompanied by the switching on/off of the light icon on the HMI terminal. Parameter H8 allows selecting whether to associate the time bands with the auxiliary output or the light. Time bands are configured using parameters tS1…8, tE1…8.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOE	Assign light digital output - see DOA	1	0	6/7	-	S	NO
H8	Output switched with time bands: 0 = light; 1 = auxiliary output.	0	0	1	-	S	NO
tS1..8-d	Start time band 1 to 8 - day: 0 = event disabled; 1 to 7 = Monday to Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
tS1..8-time	Start time band 1 to 8 - time (only for App APPLICA)	00:00:00	00:00:00	23:59:59	time	S	NO
tE1..8-d	End time band 1 to 8 - day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-time	End time band 1 to 8 - time (only for App APPLICA)	00:00:00	00:00:00	23:59:59	time	S	NO

Light dependent on main in the secondary units (par. DOF)

The action on the light output is propagated via LAN from the main to the secondary units where the light output is configured as dependent on the main via parameter DOF. Therefore, this output follows the behaviour of the main's light output. The switching on/off of the output is accompanied by the switching on/off of the light icon on the HMI terminal of the secondary.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOF	Assign light digital output serving the main on secondary devices - see DOA	0	0	6/7	-	S	NO

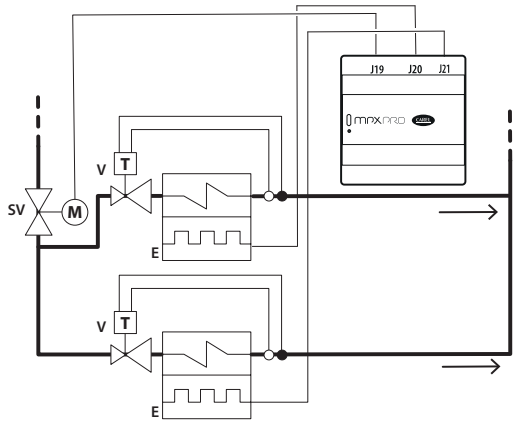
Defrost (par. DOG)

The activation/deactivation of the output configured via parameter DOG follows the defrost settings (see "Defrost" paragraph). The switching on/off of the output is accompanied by the switching on/off of the defrost icon on the HMI terminal.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOG	Assign defrost digital output - see DOA	3	0	6/7	-	S	NO

Auxiliary evaporator defrost (par. DOH)

This output can be used to activate a heater to perform resistance defrosting on the auxiliary evaporator, as shown in the example diagram.



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

Fig. 6.d

Notice: the use of two evaporators with the electronic valve requires careful system design and load balancing.

MPXPRO 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	Defrost
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. 6.g

Code	Description	Def	Min	Max	UOM	User	User terminal
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	8	-	S	YES
/FF	Assign defrost temperature probe 2 (Sd2) - see /FA	0	-4	8	-	S	YES
DOG	Assign defrost digital output - see DOA	3	0	6/7	-	S	NO
DOH	Assign auxiliary evaporator defrost digital output - see DOA	0	0	6/7	-	S	NO
DOHE	Assign hot gas valve equalisation output - see DOA						

Evaporator fans (par. DOI)

Once the digital output has been selected, the evaporator fan on/off is signalled by 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 evaporator fan digital output - see DOA	4	0	6/7	-	S	NO

Auxiliary compressor (par. DOk)

Parameter DOk allows selecting the digital output for the auxiliary compressor. See the "Compressor" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOk	Assign second ON/OFF compressor digital output - see DOA	0	0	6/7	-	S	NO

Liquid valve (par. DOn)

Parameter DOn allows selecting the digital output for the liquid valve required during the pump-down phase. See the "Defrost" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOn	Assign digital output for liquid valve - see DOA	0	0	6/7	-	S	NO

Output associated with the timer function (param. DOo)

Parameter DOo allows selecting the digital output associated with the timer function. To enable the timer function, the corresponding digital input must be configured via parameter DIL. See the "Digital inputs" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIL	Assign timed digital input - see DIA	0	-1	41	-	S	NO
dIt	Timer duration for timed digital input (0 = function disabled)	0	0	999	min	S	YES
DOo	Assign timed digital output - see DOA	0	0	6/7	-	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 condensate drain pan heater digital output - see DOA	0	0	6/7	-	S	NO

Anti-sweat heater (par. DOQ)

Parameter DOQ allows selecting the digital output for performing glass door anti-sweet (fixed activation control).
See the "Anti-sweat heater or fan modulation" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOQ	Assign anti-sweat heater digital output - see DOA	0	0	6/7	-	S	NO

Generic function On/Off type (par. DOS)

Parameter DOS allows selecting the digital output for configuring an On/Off (step) function. See the "Generic functions – On/Off output (step)" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOS	Assign digital output for generic stepped function - see DOA	0	0	6/7	-	S	NO

Condenser fans (par. DOt)

Parameter DOt allows selecting the digital output for controlling the condenser fans. See the "Condenser fans" paragraph.

Code	Description	Def	Min	Max	UOM	User	User terminal
DOt	Assign condenser fan digital output - see DOA	0	0	6/7	-	S	NO

6.2 Unit ON/OFF

The unit can be switched on and off from:
- user terminal (ON and ONK parameters);
- supervisor (ONS parameter);
- digital input (DIF parameter).

Code	Description	Def	Min	Max	UOM	User	User terminal
DIF	Assign remote ON/OFF digital input - see DIA	0	-1	41	-	S	NO
ON	Unit On/Off command: 0 = OFF; 1 = ON.	0	0	1	-	S	NO
ONK	Enable unit On/Off command from HMI terminal	1	0	1	-	S	NO
ONS	Unit On/Off command from supervisor	0	0	1	-	S	NO

All these actions have the same shutdown priority; therefore, it is sufficient for just one condition to request shutdown in order to switch off the unit. Conversely, all conditions must request startup for the unit to switch on.

On/Off from the HMI terminal and from the supervisor can be enabled using the respective parameters ONK and ONS: if disabled, the commands are ignored.

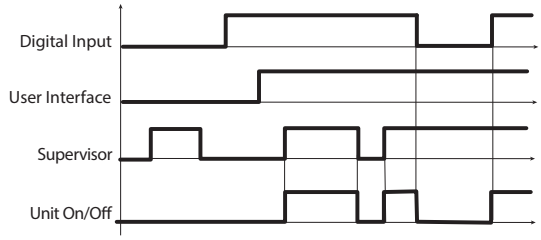


Fig. 6.e

During the Off state, the standard display alternates with the message "OFF".

With the unit switched off, it is possible to:
- access parameters from the HMI terminal;
- view alarms for probe errors (rE, E1, E2, E3, etc.) and errors Etc, Edc, alternating with the "OFF" message.

When the unit is switched off, the following alarms are reset:
- high and low temperature alarms;
- door open (dor);
- valve alarms (LSA, LowSH, MOP).

6.3 Control

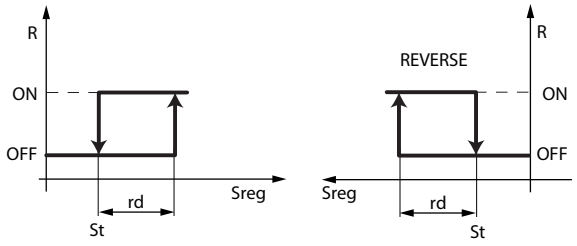
6.3.1 Introduction

The On/Off temperature control of the case is based on two fundamental parameters:
- set point St;
- differential rd.

These values determine the control request and, unless inhibited by protection timings, lockouts, or activation/deactivation delays, the opening/closing of the solenoid.

Code	Description	Def	Min	Max	UOM	User	User terminal
St	Set point	50/ 122	r1	r2	°C/°F	S	YES
rC	Operating mode: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
rd	Differential	2/ 3.6	0.1	99.9/ 179.8	Δ °C/°F	S	YES

HACCP note: the set point and differential are critical parameters for food preservation. Modification may be prohibited by HACCP procedures or subject to logging and authorization.



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

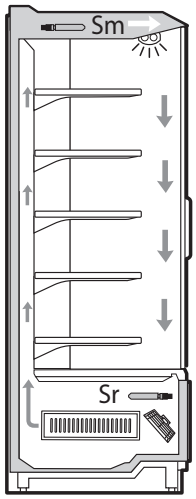
Fig. 6.f

An On/Off type control is influenced by the product's ability to absorb and release heat, as well as by the evaporator's cooling time. As a result, the temperature fluctuates above and below the set point, which may compromise food preservation quality. Reducing the differential to improve control stability leads to an increase in the frequency of solenoid opening/closing cycles.

By setting parameter rC = 1, it is possible to enable reverse operation, suitable for hot cabinet applications.

For refrigerated case control, there are different ways to control air temperature for food preservation, depending on the control probe selected. The figure shows a possible example of the positioning of the Intake probe Sr and the Outlet probe Sm.

Example: wall cabinet



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

Fig. 6.g

Control based on the intake probe, due to the high temperatures outside the cabinet and the mixing of air when the door is opened, may result in the set point not being reached, and the temperature shown on the display for the return air may appear too high. On the other hand, setting a set point too low on the intake probe Sr could lead to a risk of food freezing.

Conversely, control based on the outlet probe may result in the set point being reached even when the internal temperature of the cabinet is too high for proper food preservation, and the temperature displayed for the supply air would appear too low. Setting a set point too low on the intake probe Sr could lead to a risk of food freezing.

Weighted control (or on virtual probe Sv, parameter /4)

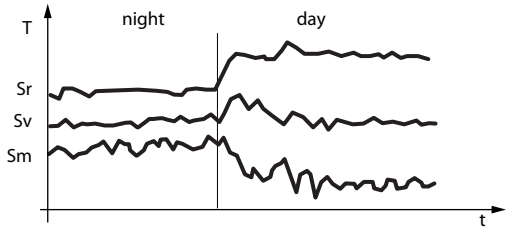
If you want to control the temperature based on a weighted average between supply and return, you can configure the virtual probe Sv accordingly. Based on parameter /4, it will provide a value calculated using the following formula:

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

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	YES

For example, if /4 = 50, then Sv = (Sm + Sr) / 2 represents the estimated value of the air temperature at the point where the refrigerated goods are located.

This type of control compensates for the disadvantages of control based solely on the outlet probe or solely on the Intake probe: the value of the virtual probe becomes the average of the supply and return probe readings, which best corresponds to the actual temperature of the goods. Another advantage of controlling on the virtual probe is the automatic adaptation to different load conditions, so that the supply temperature varies in order to keep the average temperature constant.



Ref.	Description
T	Temperature
t	Time
Sr	Intake probe
Sv	Virtual probe
Sm	Outlet probe

Fig. 6.h

HACCP note: by modifying parameter /4, the temperature used for control and the one displayed can be changed. This operation might be prohibited by HACCP procedures or subject to registration and authorization.

Control temperature display on the HMI terminal (par. /t1 and /t2)

Using parameters /t1 and /t2, it is possible to show on the HMI terminal and remote terminal a selected value among one of the probes, the control probe, the set point, or the virtual probe.

Code	Description	Def	Min	Max	UOM	User	User terminal
/t1	Display on user terminal: 0 = terminal disabled; 1...8 = probe 1 to 8; 9 = control probe; 10 = virtual probe (Sv); 11...14 = serial probe 1 to 4; 15 = temp. set point; 16 = superheat.	9	0	16	-	S	YES
/t2	Display on remote display - see /t1	0	0	16	-	S	YES

Minimum and maximum allowed values for the set point (par. r1 and r2)

It is possible to define via parameter the minimum and maximum value that the set point can assume. These parameters are defined by the manufacturer and are used to limit the operation of the unit within a known working range.

Code	Description	Def	Min	Max	UOM	User	User terminal
r1	Minimum allowed value for the set point	-50/ -58	-50/ -58	r2	°C/°F	M	YES
r2	Maximum allowed value for the set point	50/ 122	r1	200/ 392	°C/°F	M	YES

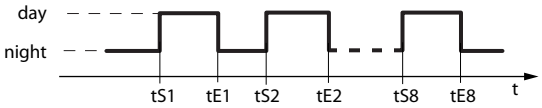
Night operation (par. r4 and r6)

During night operation, the mixing of cold internal air with warm external air decreases because the doors are not opened or the cabinet curtain is closed, thus reducing the thermal load. To avoid excessively low temperatures and excessive energy consumption, it is possible to raise the night set point by setting parameter r4.

Moreover, since the air temperature cooling the goods is close to the delivery temperature, it is possible to assign the virtual probe Sv or the intake probe Sr as the night control probe using parameter r6.

Switching to night operation occurs via the curtain switch, configurable with parameter DIG, which signals that the curtain is down, by setting time bands (parameters tS1…tS8 and tE1…tE8), by supervisor, and for the secondary controllers via the main command over the LAN network.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIG	Assign curtain contact digital input - see DIA	0	-1	41	-	S	NO
r4	Automatic night set point variation	0	-50/ -90	50/ 90	Δ °C/°F	M	YES
r6	Probe for night-time control: 0 = virtual probe (Sv); 1 = intake probe (Sr).	0	0	1	-	M	YES
tS1..8-d	Start time band 1 to 8 - day: 0 = event disabled; 1 to 7 = Monday to Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
tS1..8-time	Start time band 1 to 8 - time (only for App APPLICA) - see (td1...8-d)	00:00:00	00:00:00	23:59:59	time	S	NO
tE1..8-d	End time band 1 to 8 - day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-time	End time band 1 to 8 - time (only for App APPLICA) - see (td1...8-d)	00:00:00	00:00:00	23:59:59	time	S	NO



HACCP note: ensure that the modification of the night set point (par. r4) is authorised by the site's HACCP procedures. If required, follow the expected authorisations and registrations.

Night operation is summarised in the following table:

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	
Light	ON	OFF	

Tab. 6.h

Shared solenoid valve in network (par. r7)

In applications where the solenoid valve is shared between main and secondary, it is possible to configure the solenoid output as a network solenoid output by setting parameter r7 = 1 on both main and secondary controllers.

Code	Description	Def	Min	Max	UOM	User	User terminal
r7	Main solenoid valve configuration: 0 = local valve; 1 = network valve (connected to the main).	0	0	1	-	M	YES

If configured as a network solenoid, the valve is:

- open: if at least one control is requesting cooling;
- closed: if no control is requesting cooling or if at least one control is in major valve alarm (low superheat, low suction temperature, high evaporation pressure), if properly configured. See parameters P10 and PM5.

Notice: in the case of a main/secondary network with shared solenoid, it is necessary to correctly set parameter r7 in all devices (r7 = 1).

Code	Description	Def	Min	Max	UOM	User	User terminal
P10	Enable close solenoid valve for low superheat (LowSH and/or low suction temperature LSA): 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	SI
PM5	MOP, enable solenoid valve closing: 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	SI

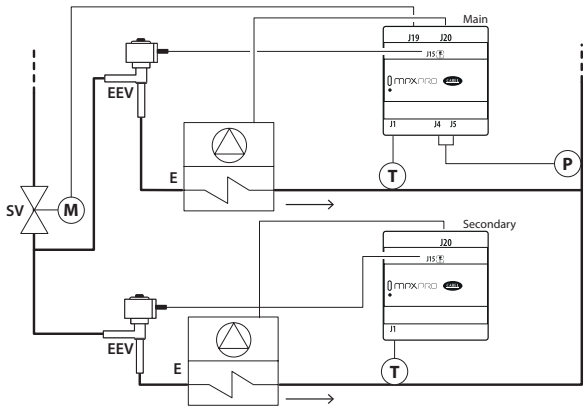


Fig. 6.i

Ref.	Description
E	Forced-air evaporator
SV	Solenoid valve
EEV	Electronic expansion valve
P	Evaporation pressure (PEu)
T	Superheated gas temperature (tGS)

Double thermostat (par. rd2 and St2)

The double thermostat function is activated by setting parameter rd2 > 0. It allows the controlled unit to automatically adapt, i.e., without set point change and without external signal, to the variation of compressor load, especially during the day/night transition and viceversa.

To achieve 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
db1	Double thermostat function logic: 0 = logical AND; 1 = logical OR.	0	0	1	-	M	NO
rd2	Intake probe differential with double thermostat function (0.0 = function disabled)	0	0	99.9/ 179.8	Δ °C/°F	M	YES
St2	Intake probe set point with "double thermostat" function	50/ 122	r1	r2	°C/°F	M	YES

Using parameter db1, it is possible to select the logical AND or OR mode with which the two conditions are evaluated.
The control request occurs:
- when both probes are in demand, as if they were two thermostats in series with db1 = 0;
- when one of the probes is in demand, as if they were two thermostats in parallel with db1 = 1.

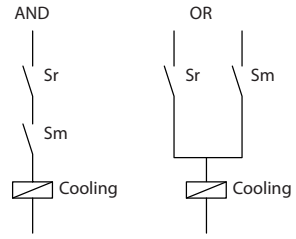


Fig. 6.j

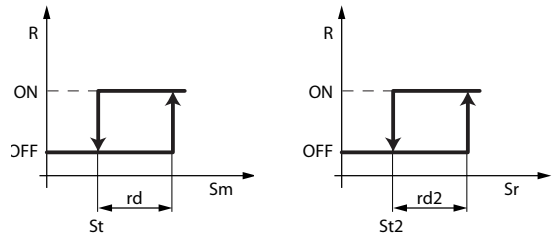


Fig. 6.k

Ref.	Description
Sm	Outlet probe
Sr	Intake probe
R	Control request
rd	Differential for St
rd2	Differential for St2

An example follows of the temperature trend of a wall cabinet during day and night. In this case, with the values in the figure and db1 = 0, during the night there would be no control request because the outlet probe is not in demand.

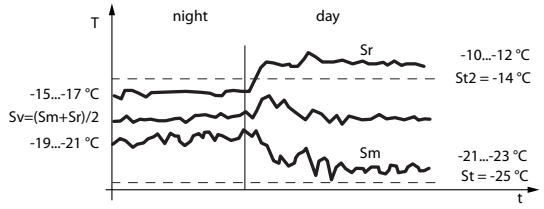


Fig. 6.l

Ref.	Description
Sm	Outlet probe
Sr	Intake probe
T	Temperature
Sv	Virtual probe
t	Time

Notice:
- If either of the two probes Sm or Sr is faulty or not configured, it is considered as being in request;
- therefore, if db1 = 1, a request is always active. If both probes Sm and Sr are faulty, the controller switches to "duty setting" operation mode (see below).

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

6.3.2 Double section refrigerated cabinet with shared EEV

This cabinet has two independent sections, each with its own evaporator and intake air probe, yet both sections share a single EEV for refrigerant flow management and a single digital output for the defrost heaters. This configuration considers the cabinet as a coordinated system: the section with the highest intake probe temperature defines the cooling request, while the alarms, defrosts and display are specific to each individual section.

Control

By setting parameter HTy = 1, the control request is activated when at least one of the two intake probes (Sr or Sr2) exceeds the threshold equal to the set point plus the differential (St + rd). Refrigeration stops only when both intake probes fall below the set point (st). As a safety protection, control stops if the temperature read by the outlet probe (Sm) falls below the MAt (minimum air-off temperature) threshold, generating a specific alarm (LO3), regardless of the status of the intake probes.

- To protect the cabinet, parameter MAt - minimum air outlet temp. (safety) - should be set based on how sensitive the goods are to frost, as this has priority to override control.

Management in the event of probe failure

In the event of a single intake probe failure, control continues based on the other, functioning probe. If both intake probes fail, the system continues control based on the outlet probe (Sm), applying the control offset ro (virtual set point = St + ro). If all three main probes (Sr, Sr2, Sm) fail, duty cycle mode is activated, with an on time defined by parameter c4 and a fixed off time of 15 minutes.

Defrosting

Defrosting can be activated in the same way as on a standard cabinet, and runs simultaneously on both evaporators. The cycle ends when both defrost probes (Sd and Sd2) exceed their respective thresholds (dt1 and dt2), or when the maximum duration dP1 is reached. If a timed defrost has been set (d0 = 2, 3), the duration is defined solely by dP1. The system stops defrosting for safety if one of the intake probes exceeds the limits dET or dET2, while the protection parameter dEO switches off the heaters if the evaporator temperature rises excessively.

- With timed defrosts (d0 = 2 or 3), the system ignores the readings of probes Sd and Sd2 and the cycle ends only when the time dP1 has elapsed.

Alarms and display

The high and low temperature alarms are specific to each section (AA, AA2, AH, AH2, AL, AL2). The two local displays show the intake probe temperature for section A (Sr) and section B (Sr2) respectively. The display can be configured to show the higher temperature of the two sections, by selecting the optional virtual probe mode.

Double cabinet parameter table

The parameter descriptions and access levels have been harmonised with the official manual.

Code	Description	UOM	Def	Min	Max	User	Display	Notes
HTy	Hardware type (0=std, 1=2evap+1EEV)	-	0	0	1	M	NO	Mandatory. Enable double cabinet logic.
St	Control set point	°C/°F	50	-50	200	S	SI	Common set point for both sections.
rd	Control differential	°C/°F	2	0.1	99.9	S	SI	Common differential for both sections.
d0	Type of defrost	-	0	6	0	S	SI	Defrost cycle configuration
P3	Superheat set point	K	10	0	25	S	SI	Superheat set point for the common EEV.
MAt	Minimum air outlet temp. (safety)	°C/°F	-50	-50	50	S	SI	Stops refrigeration if the outlet is too cold.
dt1	End defrost temperature (read by Sd)	°C/°F	8	-50	50	S	SI	Threshold for evaporator A.
dt2	Secondary evaporator end defrost temperature (read by Sd2)	°C/°F	8	-50	50	S	SI	Defrosting ends when both are OK.
dP1	Maximum defrost duration	min	45	1	240	S	SI	Safety time for the active phase.
dd	Dripping time (fans off) after defrost	min	2	0	15	S	SI	Defrost post-dripping phase.
fd	Post-dripping time after defrosting	min	2	0	15	S	SI	Fans OFF with control active.
rHu	Manual anti-sweat heater activation percentage	%	70	0	100	S	SI	Glass heater management.
rHt	Manual anti-sweat heater activation period	min	5	0	180	S	SI	Heater cycle time.
r4	Automatic night-time set point variation	°C/°F	0	-50	50	M	SI	Set point increase at night.
---	SPECIFIC PROBE PARAMETERS							
/Fc2	Intake probe 2 channel (sr2)	Chan. no.	0	-4	8	S	No	Section B intake probe.
/cc2	Intake temperature probe 2 calibration	°C/°F	0	-20	20	S	No	Specific calibration factor for sr2.
/FF	Assign defrost temperature probe 2 (Sd2)	Chan. no.	0	-4	8	S	SI	Section B defrost probe.
/cF	Defrost temperature probe 2 (Sd2) calibration	°C/°F	0	-20	20	S	SI	Specific calibration factor for sd2.
---	SECTION B DISPLAY AND ALARMS							
AA2	Assign alarm 2 probe	-	3	0	14	M	SI	Section B temperature alarm probe.
AH2	Relative high temperature alarm threshold 2	°C/°F	0	0	50	S	SI	Section B high threshold.
AL2	Relative low temperature alarm threshold 2	°C/°F	0	0	50	S	SI	Section B low threshold.
/t1 (*)	Display	Value	0	0	16	S	SI	Section A display (shows Sr probe)
/t2 (*)	Display on remote display	Value	0	0	16	S	SI	Section B display (shows Sr2 probe)

Tab. 6.i

(*) to comply with EN13485 for double-section cabinets, the use of two displays is recommended, configured via /t1 and /t2 to show the respective intake probe readings.

Control offset for probe error (par. ro)

Code	Description	Def	Min	Max	UOM	User	User terminal
ro	Control offset with probe error	0	0	20/ 36	°C/°F	S	YES

In standard mode, MPXPRO uses the virtual probe Sv for control, which is the weighted average of the outlet probe and intake probe (see parameter /4). In the event of a failure of one of the two probes forming the virtual probe, the parameter ro allows normal control to continue under controlled conditions, without the need for immediate intervention by maintenance personnel. The recommended value of ro to use is the temperature difference read between the Outlet probe and Intake probe under stable operating conditions of the refrigeration unit:

$$ro = Sr - Sm$$

The following cases occur:

- **Outlet probe Sm failure:** MPXPRO begins to control based solely on the intake probe Sr considering a new set point (St') determined by the formula:

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

- **Intake probe Sr failure:** MPXPRO begins to control based solely on the outlet probe Sm considering a new set point (St') determined by the formula:

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

If the intake probe has been set as the control probe during night operation, the controller sets /4 = 100 and switches to the outlet probe. The new set point becomes:

$$St' = St - ro$$

Notice:

- If ro = 0 the functionality is not active.
- In case of night operation, the calculated set point is increased by the value defined by r4 (= automatic night set point shift).
- If both probes fail, the controller switches to "duty setting" operation (see below).

Example

Let /4 = 50, St = -4, Sr = 0, Sm = -8 -> recommended ro = 0 - (-8) = 8 and Sm fails during daytime operation. Then the new control probe becomes Sr with:

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

St' = -4 + 8*(100-50)/100 = 0.

If Sr fails, the new control probe becomes Sm with:

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

St' = -4 - 8*50/100 = -8.

"Duty setting" operation (par. c4)

Duty setting operation allows control to remain active in the event of failure of both temperature probes used for control, while awaiting maintenance. Control is activated at regular intervals, with ON time equal to the value set by parameter c4 and a fixed OFF time of 15 minutes. Duty setting begins with ON time if the solenoid/compressor was active at the moment of switching to this mode; otherwise, it starts with OFF time.

Code	Description	Def	Min	Max	UOM	User	User terminal
c4	Solenoid/compressor ON time for duty setting operation: 0 = always OFF; 1-99 = minutes ON (Toff = 15 minutes fixed); 100 = always ON.	0	0	100	min	M	YES

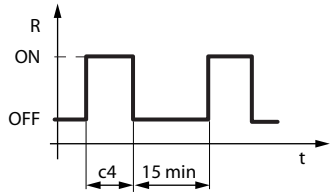


Fig. 6.m

Ref.	Description
R	Control
c4	ON time
t	Time

With duty setting active, during the ON time the solenoid/compressor icon remains lit, while it flashes during the OFF state. The table below describes the possible probe fault scenarios and the corresponding active function.

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

* ro must be > 0.

Tab. 6.j

Duty setting with shared control status

If the control status is shared (parameter /FA = 0 and /Fc = 0 on MPXPRO secondary controllers), the activation of the duty setting mode is shown on the main HMI terminal by the steady illumination of the solenoid/compressor icon and the presence of the control probe alarm rE, whereas the display on the secondary is not affected by the operating mode of the main. Conversely, if the secondary enters duty setting mode due to a loss of communication with the main, the display on the secondary HMI terminal follows the standard rules: the solenoid/compressor icon remains lit during the ON period and flashes during the OFF state; additionally, the HMI terminal displays the communication loss alarm with the main MA. In this case, control activates the duty setting according to the c4 parameter set on the secondary.

Notice:

- the activation of the duty setting mode on the main controller implies that all secondary controllers controlled by it follow the same solenoid/compressor timing as the main controller;
- compressor protection timings are respected during duty setting;
- if an auxiliary On/Off compressor with start delay is managed, both compressors will be activated according to the configured timing. It is important to set parameter c4 correctly in relation to activation delay c11.

Continuous cycle (parameter cc)

The continuous cycle is a function that keeps refrigeration active continuously for a configurable duration, regardless of the internal temperatures of the unit. This can be useful if a rapid temperature drop is required, even below the set point. The delay of the low temperature alarm, caused by exceeding the thresholds set by parameters AL (ALA) or AL2 (ALA2) in double thermostat functionality, can be adjusted using parameter c6. See the "Temperature Alarms" section.

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

Code	Description	Def	Min	Max	UOM	User	User terminal
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	YES
cc	Running time in continuous cycle (0 = function disabled)	0	0	15	hours	M	YES

The continuous cycle can be activated through the direct function from the HMI user terminal (see "Direct commands" section), from supervisor or via digital input. During the execution of the continuous cycle:

- the icons ❄ + ☑ are displayed;
- the solenoid/compressor output is activated (with icon), as well as the electronic valve control;
- the low temperature alarm is enabled with a threshold set via parameter AL (ALA) referring to the probe defined by parameter AA, and a second low temperature alarm with threshold set via parameter AL2 (ALA2) referring to the probe defined by parameter AA2.

Caution: Caution: for correct operation of the low temperature alarms, configure the following parameters as follows:

- AA = Outlet probe Sm;
- AA2 = Intake probe Sr.

Notice:

1. The continuous cycle cannot be activated if:
   - the continuous cycle duration is set to 0 (cc = 0);
   - the readings of the probes defined by parameters AA and AA2 are below their respective thresholds AL (ALA), AL2 (ALA2);
   - the device is OFF.
2. The continuous cycle remains in standby if:
   - compressor protection times are set (parameters c1, c2, c3);
   - an immediate or delayed alarm from external digital input delays the solenoid activation;
   - defrost, dripping, or post-dripping are in progress;
   - the door is open. When the door is opened, the continuous cycle is suspended and resumes upon closure, for the remaining time.
3. The continuous cycle ends:
   - when the direct function is disabled from the HMI user terminal (see "Direct commands" section);
   - upon reaching either of the low temperature thresholds set by parameters AL (ALA) or AL2 (ALA2) with double thermostat functionality;
   - at the end of the time set by parameter cc;
   - due to shutdown from the supervisor (logical OFF);
   - by command from the supervisor.

Notice: in case of auxiliary On/Off compressor management with start delay, during the continuous cycle both compressors will be activated according to the configured timing.

Continuous cycle with shared control status

If the control status is shared (parameter /FA = 0 and /Fc = 0 on MPXPRO secondary controllers), the activation of the continuous cycle mode is indicated on the main HMI terminal by the steady illumination of the ❄ + ☐ icons. Secondary controllers ignore the main's control mode and continue standard control, managing the display as usual (solenoid icon ON during cooling request and OFF otherwise).

Defrost priority over continuous cycle

Using parameter c7, it is possible to define the priority between the continuous cycle and defrost.

Code	Description	Def	Min	Max	UOM	User	User terminal
c7	Defrost priority over continuous cycle: 0 = continuous cycle has priority; 1 = defrost has priority.	0	0	1	-	M	YES

If c7 = 0, defrost and continuous cycle are non-interruptible (equal priority): any defrost or continuous cycle request arriving during the other process will remain on hold. If c7 = 1, a defrost request arriving during the execution of the continuous cycle will prematurely end the continuous cycle and initiate defrost.

6.4 Defrost

6.4.1 Introduction

MPXPRO allows the management of different defrost types, depending on parameter d0. Defrost termination can be based on temperature, in which case the defrost probe Sd must be installed, or on time. In the first case, the defrost ends if the temperature detected by the defrost probe Sd exceeds the defrost stop value set via parameter dt1, or if the maximum time set via parameter dP1 has elapsed; in the second case, defrost ends after the dP1 time has elapsed.

During defrost, it is possible to select the information shown on the HMI user terminal and remote display using parameter d6: the value selected by parameter /t1 alternated with the message "dEF", the last value measured before the defrost (frozen), or only the message "dEF".

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; 5 = hot gas by temperature; 6 = hot gas by time.	0	0	4	-	S	YES
d6	Display on terminal during defrost: 0 = temperature alternating with 'dEF'; 1 = freeze display; 2 = 'dEF'.	1	0	2	-	S	YES
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	YES
dt1	End defrost temperature (read by Sd)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES
dP1	Maximum defrost duration	45	1	240	min	S	YES
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	8	-	S	YES

Notice: it is possible to disable high temperature alarms after defrosting: high temperature alarms are ignored for a time equal to the value set via parameter d8. See the section "Temperature alarms" for details.

Below is showed the behavior of the defrost output according to the setting of parameter d0.

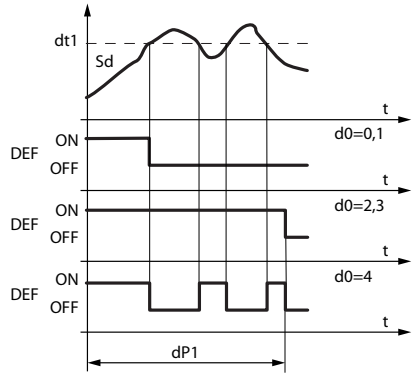


Fig. 6.n

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

Thermostatically controlled electric defrost with time limit (d0 = 4) allows activation of the defrost output only if the evaporator temperature (Sd) is lower than the value of parameter dt1, and ends after the time defined by parameter dP1. This function is useful for energy savings and to prevent excessive temperatures on the evaporator.

During defrosting, the fans can either follow the setting of parameter F0 or remain off, according to the value set with parameter F3. At the end of defrosting, it is possible to enable the drip phase (active if parameter dd > 0), during which the solenoid valve is closed and the fans are off. Subsequently, the post-drip phase can be activated (active if parameter Fd > 0), during which control

resumes and the fans follow the setting of parameter Fpd.

Code	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time (fans off) after defrost (0 = no dripping)	2	0	15	min	S	YES
F0	Evaporator fan management (Sa = first probe, Sb = second probe, par. FSa, FSb): 0 = always on; 1 = activation based on Sa - Sb (see FSa and FSb); 2 = activation based on Sa; 3 = fans on with door closed (door contact configured, par. DIP).	0	0	3	-	S	YES
F3	Evaporator fans during defrosts: 0 = ON; 1 = OFF.	1	0	1	-	S	YES
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	YES
Fpd	Evaporator fans during post-dripping: 0 = On, 1 = Off	1	0	1	-	S	NO

Through parameters td1…td8, it is possible to set up to 8 defrost events linked to the control's real-time clock (RTC), as well as the activation of Power Defrost (see end of paragraph).
To configure parameters td1…td8, you can use either the supervisor system 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 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal; 1 = power defrost.	0	0	1	-	S	NO
td1..8-time	Defrost 1 to 8 – time (APPLICA app only)	00:00:00	00:00:00	23:59:59	time	S	NO

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

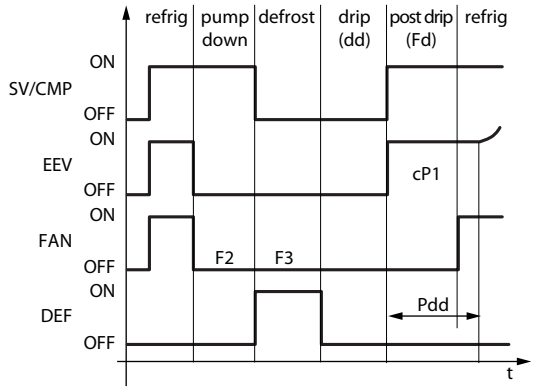


Fig. 6.0

Ref.	Description
t	Time
SV/CMP	Solenoiod/ compressor
EEV	Electronic expansion valve
FAN	Fans
DEF	Defrost
refrig	Control
pump down	Pump down
defrost	Defrost
drip	Dripping
post drip	Post-dripping

Notice: the work cycle is based on the default values of parameters F2 and F3.

The pump down phase is the phase in which the evaporator is emptied of the refrigerant liquid, and it can be disabled by setting dH1 = 0 (see section "Pump Down Phase Duration").

The operation of the fan during the pump down phase depends on parameters F2 and F3. During the drip phase, the fan is always off, while during the post-drip phase, it depends on parameter Fpd.

During defrost, the electronic valve can either follow the control according to the selected defrost type, be forced closed, or be opened to a fixed percentage, according to the setting of parameter dSb. At the end of the defrost, the electronic valve can be forced to open to the initial value set by parameter cP1 for a time defined by parameter Pdd.

Code	Description	Def	Min	Max	UOM	User	User terminal
cP1	Valve position when control starts	30	0	100	%	S	YES
dH1	Pump down duration (0 = pump down disabled)	0	0	999	s	S	YES
dSb	Valve position during defrost: 0 = as defined by the type of defrost; 1 = forced closed; 2 to 100 = opening percentage.	0	0	100	%	S	YES
F2	Evaporator fans with compressor off: 0 = see F0; 1 = always off.	1	0	1	-	S	YES
Pdd	Initial valve position maintenance time after defrost	10	0	30	min	M	YES

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

MPXPRO 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).

The pump down phase is the phase during which the evaporator is emptied of refrigerant liquid and can be disabled by setting dH1 = 0 (see the section "Pump Down Phase Duration").

During the hot gas defrost phase, the hot gas solenoid valve (HGSV) is opened, and the electronic expansion valve (EEV) can either follow the control according to the selected defrost type, be forced closed, or opened to a fixed percentage, according to the value set by parameter dSb.

The operation of the fan during the Pump Down and Hot Gas Defrost phases depends on parameters F2 and F3.
During the drip phase, the fan is always off, while during the post-drip phase, it depends on parameter Fpd.

During defrost, the electronic valve can follow the control depending on the chosen defrost type, be forced closed, or be opened to a fixed percentage, according to parameter dSb (default = closed). At the end of defrost, it is possible to force the electronic valve to open to the initial value set by parameter cP1 for a time defined by parameter Pdd.

In the case of hot gas defrost, when using valves with a non-negligible actuation time, it may be necessary to equalize the pressure in the circuit before allowing the hot gas to circulate through the evaporator. For this purpose, it is possible to:
- open the liquid valve located before the evaporator;
- delay the compressor start.

The parameter that defines the actuation time for the hot gas valve is dHG, which must be set to a value greater than or equal to the time declared by the manufacturer for the complete movement of the valve.

Code	Description	Def	Min	Max	UOM	User	User terminal
dHG	Hot gas valve movement duration	0	0	300	s	S	YES

When defrost is triggered, the hot gas valve begins to open before entering the active defrost phase.
Similarly, when exiting the defrost phase, the valve starts to close before the actual end of the cycle.

Duty cycle with ON/OFF compressor

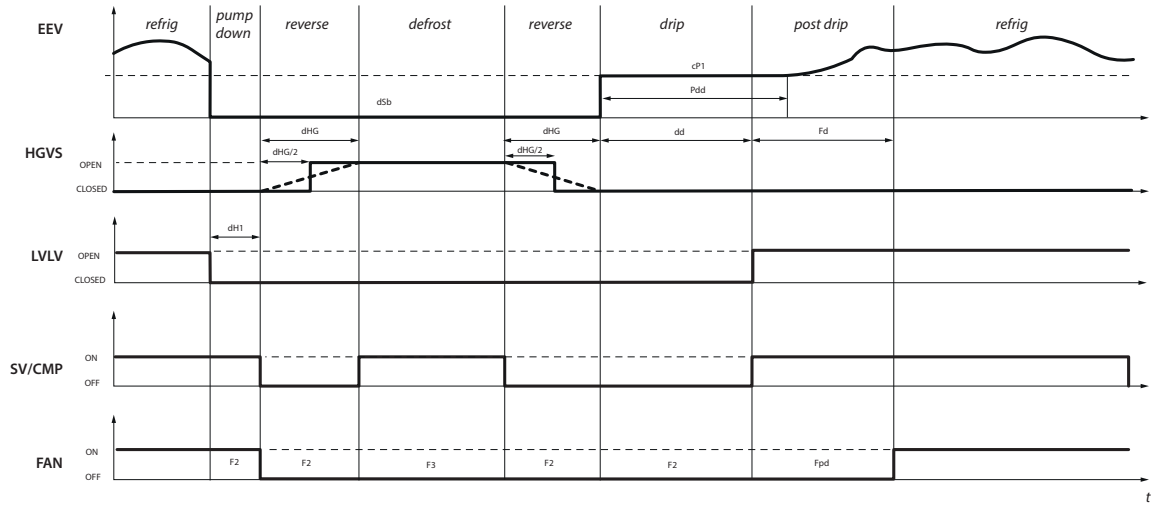


Fig. 6.p

Notice: the operating cycle refers to the default values of parameters F2 and F3.

Ref.	Description
t	Time
EEV	Electronic expansion valve
HGVS	Hot gas valve
LVLV	Liquid valve
SV/CMP	Solenoiod/ compressor
FAN	Fans

Ref.	Description
refrig	Control
pump down	Pump down
reverse	Valve reverse
defrost	Defrost
drip	Dripping
post drip	Post-dripping

Working cycle with VCC compressor

The working cycle with a VCC (variable capacity compressor) is similar to that of an On/Off compressor but differs in the behavior of the compressor itself:

- defrost start: the liquid valve is closed, and after the pump down phase, during which the compressor drops to the minimum frequency set via parameter cnf, a switching command is sent to the Hot Gas Valve.
- active defrost phase: after the Hot Gas Valve reaches its final position (par. dHG), the compressor ramps up to the frequency set via parameter cdF.
- end of defrost: the Hot Gas Valve starts its movement, the compressor is kept running at the minimum speed set via parameter cnf, and the liquid valve remains closed. Once the Hot Gas Valve finishes its movement (par. dHG), the system proceeds to the following phases (dripping, post-dripping, control).

Code	Description	Def	Min	Max	UOM	User	User terminal
cdf	VCC compressor frequency for hot gas defrost	140	0	255	Hz	M	YES
cMf	Maximum VCC compressor control frequency	100	0	255	Hz	M	YES
cnf	Minimum VCC compressor control frequency	52	0	255	Hz	M	YES
ddf	VCC compressor frequency during dripping	140	0	255	Hz	M	NO

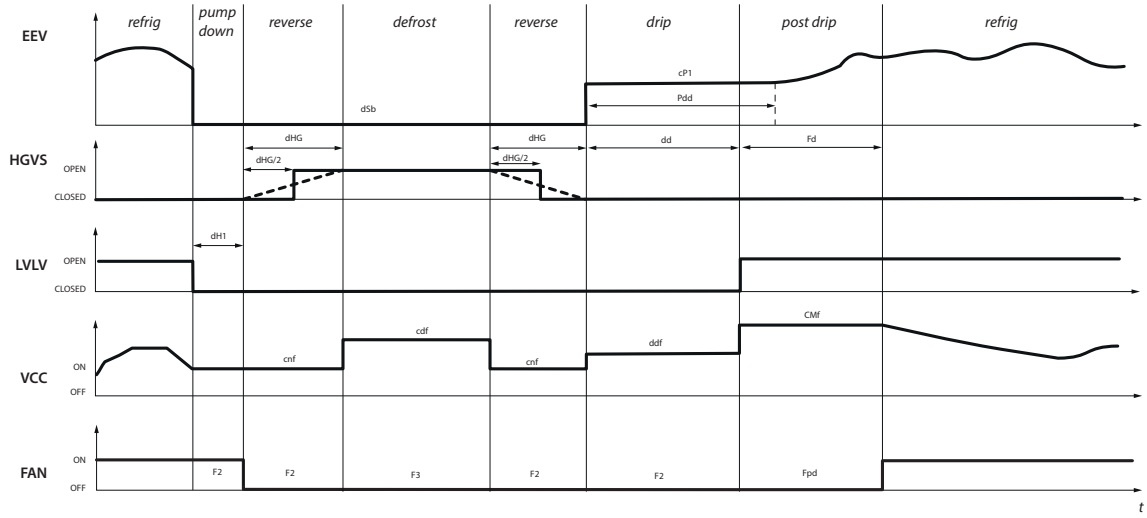


Fig. 6.q

Ref.	Description
t	Time
EEV	Electronic expansion valve
HGVS	Hot gas valve
LVLV	Liquid valve
VCC	VCC compressor
DEF	Defrost

Ref.	Description
refrig	Control
pump down	Pump down
reverse	Reverse valve
defrost	Defrost
drip	Dripping
post drip	Post-dripping

6.4.4 Centralised hot gas defrost (d0=5, 6)

Hot gas defrosting (CO_2)

Hot gas defrosting is an energy-efficient solution, however in CO2 systems it requires close control due to the higher operating pressures compared to traditional refrigerant systems; consequently, the MPXPRO controller features logic that prevents mechanical and thermal shock on the evaporators.

Notice:

- for mechanical safety, set dSV and dHG according to the actual travel times of the motor-driven ball valves (typically between 30s and 120s).
- The EEV valve must be closed during defrosting (dSb = 1) to prevent uncontrolled liquid return to the compressors.
- If using a stepper valve, it is recommended to install a solenoid valve in series with the EEV.

Local components and valves

Principle diagram:

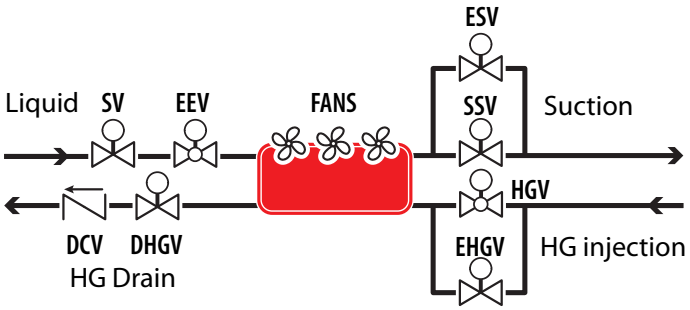


Fig. 6.r

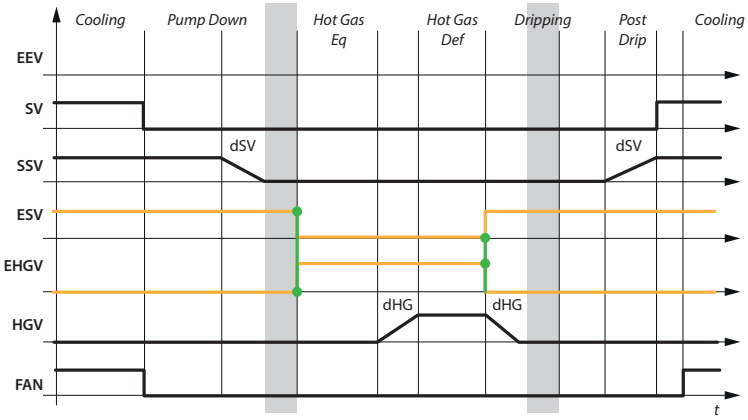
The system coordinates four main valves connected to the controller:
- **HGV** (main hot gas valve): Main valve for hot gas injection.
- **EHGV** (HG equalising valve): Bypass valve for slow pressurisation before defrosting.
- **SSV** (suction stop valve): Motor-driven valve (typically a ball valve) to isolate the evaporator from the suction line.
- **ESV** (suction equalising valve): Bypass valve for gradual pressure release after defrosting.
- **SV** xxxxx
- **HGV** xxxxx
- **EEV** xxxxx
- **DCV** xxxxx

On main/secondary networks:
- no local defrosting is possible;
- the end of hot gas defrosts must be synchronised;
- the hot gas valve is always local only (one for each controller);
- the liquid solenoid valve can be local or shared in the network;
- the suction and equalising valves can be local or shared in the network;
- the change from one phase to another is always synchronised between all controllers;
- the durations of the various phases are controlled via the main parameters, the corresponding parameters on the secondary controllers are not considered.

Defrost is activated:
- by setting the event and the starting mode, with a maximum of 8 defrosts per day (parameters td1 to td8);
- from the supervisor, which sends the defrost request to the main controller; this in turn sends it to the secondary controllers;
- via digital input: on a main/secondary network, defrosting is controlled over the network.

Operational sequence

The MPXPRO logic manages the cycle through a series of phases:
1. **Refrigeration:** Standard operation with fans ON and EEV in modulating operation.
2. **Start defrost and pump down:** The liquid valve and EEV close to empty the evaporator, then the SSV closes.
3. **Pre-injection equalisation:** The EHGV opens to gently raise the coil pressure, preventing mechanical shock.
4. **Hot gas defrost active**: The HGV opens. Active defrost phase.
5. **Dripping time:** The HG valves close to drain the condensate with the fans OFF.
6. **Post-defrost equalisation:** The ESV opens to gradually lower the evaporator pressure to the suction line levels.
7. **Resume refrigeration:** The SSV and EEV are opened again to resume the refrigeration cycle.



Ref.	Description
t	Time
EEV	Electronic expansion valve
SV	
SSV	Motor-driven valve (typically a ball valve) to isolate the evaporator from the suction line
ESV	Bypass valve for gradual pressure release after defrosting
EHGV	Bypass valve for slow pressurisation before defrosting
HGV	Main valve for hot gas injection
FAN	
dSV	
dHG	

Fig. 6.s

Configuration parameter table

Code	Description	Def	Min	Max	UOM	Label	User	User terminal
GENERAL CONFIGURATION								
d0	Type of defrost: 5 or 6 for hot gas CO_2 logic	0	0	6	-	5= temperature 6= time	S	SI
F2	Fans with compressor OFF	1	0	1	-	Fan status in pump down (1=OFF).	S	SI
DIGITAL OUTPUTS (DO)								
DOn	Assign liquid valve (SV)	3	0	6	Chan. no.	Isolates the evaporator during pump-down.	S	NO
DOL	Assign intake valve (SSV)	0	0	6	Chan. no.	Manages the motor-driven SSV.	S	NO
DOAA	Assign hot gas valve (HGV)	0	0	6	Chan. no.	Main hot gas injection valve.	S	NO
DOM	Assign suction equalising valve (ESV)	0	0	6	Chan. no.	Post-defrost equalisation.	S	NO
DOHE	Assign HG equalising valve (EHGV)	0	0	6	Chan. no.	Slow pre-injection pressurisation.	S	NO
PUMP DOWN								
C10	Type of end pump down	0	0	1	-	0=Pressure; 1=Time (par. cPt).	S	NO
cPt	Maximum pump down time	0	0	900	s	Timeout for pump down phase.	S	NO
pH1	End pump down pressure	15.0	0.1	999.9	barg	Pressure threshold to end pump down.	S	NO
END DEFROST								
dt1	End defrost temperature	8.0	-50	50	°C	Probe Sd threshold to end the cycle.	S	SI
dP1	Maximum defrost duration	45	0	240	min	Active phase safety timeout.	S	SI
TIMES, PHASES AND VALVES								
dSV	SSV switching time	0	0	300	s	Motor-driven SSV operating time.	S	NO
dEH	HG equalisation time	60	0	900	s	Pre-injection phase duration (EHGV).	S	NO
dHG	HGV operating time	0	0	300	s	Motor-driven HGV operating time.	S	SI
Dd	Dripping time	2	0	15	min	Coils off to drain condense.	S	SI
dES	Suction equalisation time	60	0	900	s	Release pressure before reopening SSV.	S	NO
Fd	Post dripping time	2	0	15	min	Stabilisation before restarting fans.	S	SI
EEV								
dSb	EEV position when defrosting	1	0	100	%	1=Closed. Mandatory for CO_2.	S	SI
cP1	EEV position when starting control	30	0	100	%	Initial opening after defrosting.	S	SI
Pdd	cP1 position holding time	10	0	30	min	cP1 held in position after defrosting for stability.	M	SI

6.4.5 Defrost advanced parameters

Early defrost termination due to high temperature (par. dEP and dET)

MPXPRO allows the forced early termination of the defrost cycle if the value from a probe, configurable via parameter dEP, exceeds a threshold set by parameter dET. This function is especially useful when the defrost probe is not properly positioned, helping to prevent excessively high cabinet temperatures during defrost, particularly in the case of electric defrost systems. In the event of early defrost termination, the controller displays the specific message "dEA" on the HMI user terminal. This message is cleared only if the following defrost cycle ends correctly.

Code	Description	Def	Min	Max	UOM	User	User terminal
dEP	Select temperature probe to end defrost in advance: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = not available; 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = not available; 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu); 15 = intake temperature 2 (Sr2)	0	0	14	-	S	NO
dET	Temperature threshold to end defrost in advance	50/ 122	-99.9/ -147.8	99.9/ 211.8	°C/ °F	S	NO
dEP2	Select temperature probe 2 to end defrost in advance - see dEP	0	0	15	-	S	NO
dET2	Temperature threshold 2 to end defrost in advance - see DET	50/122	-99.9/ -147.8	99.9/ 211.8	°C/°F	S	NO

Maximum interval between consecutive defrost cycles (par. dI)

Parameter dI is a safety parameter that enables periodic defrosting at intervals no greater than the value set via dI. This is useful, for example, in cases of LAN or RS485 serial network disconnection. At the start of each defrost, regardless of its duration, a timer begins counting. If no defrost is performed within the interval set by dI, a defrost cycle is automatically activated. The timer remains active even when the controller is in the OFF state: upon restart, the controller checks if the time limit has expired and, if the conditions are met, initiates a defrost.

Notice: the time counter restarts if a Clean or Standby phase is triggered during a defrost, or if a defrost request is made but not executed due to the temperature being above the defrost termination threshold.

When set on the main controller, the dI parameter affects the entire connected LAN subnet; when set on a secondary controller, it only has local effect.

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

Example

In the event that defrost cycles are managed by a centralized system and, due to a communication failure, the request is not received, the defrost is automatically started after the safety time defined by parameter dI.

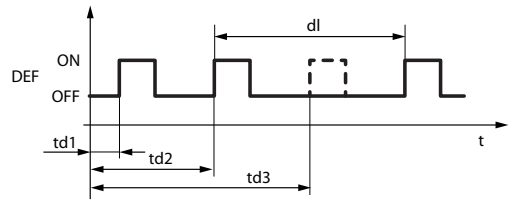


Fig. 6.t

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

Staggered defrost (parameters d1S and d2S)

This function allows multiple daily defrost cycles to be carried out by setting only the first one using parameter td1 and indicating the desired number of defrosts via parameter d1S. The controller automatically generates a schedule for all subsequent defrosts, distributing them at regular intervals over the 24 hours following the event defined by td1. Similarly, parameters td2 and d2S can be used for a second defrost series.

Code	Description	Def	Min	Max	UOM	User	User terminal
d1S	Number of daily defrosts (td1): 0 = disabled; 1 = 24 hours 0 minutes; 2 = 12 hours 0 minutes; 3 = 8 hours 0 minutes; 4 = 6 hours 0 minutes; 5 = 4 hours 48 minutes; 6 = 4 hours 0 minutes; 7 = 3 hours 26 minutes; 8 = 3 hours 0 minutes; 9 = 2 hours 40 minutes; 10 = 2 hours 24 minutes; 11 = 2 hours 11 minutes; 12 = 2 hours 0 minutes; 13 = 1 hour 0 minutes; 14 = 30 minutes.	0	0	14	-	S	YES
d2S	Number of daily defrosts (td2) - see d1S	0	0	14	-	S	YES
td1..8-d	Defrost 1 to 8 - day: 0 = event disabled; 1 to 7 = Monday to Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal; 1 = power defrost.	0	0	1	-	S	NO
td1..8-time	Defrost 1 to 8 – time (APPLICA app only)	00:00:00	00:00:00	23:59:59	orario	S	NO

Notice:

- if the td1 event spans multiple days, the scheduling will still end at 24:00 on the last day. If the td1 event covers a single day, the scheduling will end at 24:00 of that same day;
- in the case where both td1 and td2 are configured, if the defrost events overlap, only the defrost sequence that starts first will be executed.

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

The parameters determine whether, in a local network, the defrost on the main and on the secondary devices should be synchronised at the start, at the end or both.

Code	Description	Def	Min	Max	UOM	User	User terminal
d2	End defrost synchronised by main: 0 = not synchronised; 1 = synchronised.	1	0	1	-	S	YES
d3	Send start network defrost command (main): 0 = yes; 1 = no. Ignore start network defrost signal (secondary): 0 = no; 1 = yes.	0	0	1	-	S	YES

d2: end defrost synchronised by main; in general, this parameter should be set to 1 on the main and secondary units in a multiplexed group (synchronised end defrost). When synchronised end defrost is set, control in the subnetwork only resumes when all the units have finished the active defrost phase.

d3: disable network defrost; if set to 1 on a main unit, the defrost command will not be broadcast to the secondary units in the same LAN; if set to 1 on a secondary unit, this will not start the defrost procedure if receiving the command from the main.

Caution: especially in hot gas defrost systems, it is recommended to set parameter dI = 0 on all units connected in a main/secondary configuration, in order to avoid the execution of unsynchronized defrost cycles in the event of a LAN network failure.

Best practices for managing defrost in a local network of cabinets

As a general rule, in a main/secondary network:

1. A manual start of a defrost (from the user interface or APPLICA) is always performed by the controller itself and not broadcast across the network to the other controllers.
2. Defrost is activated:
   - by appropriately setting d3, on the main and secondary units; the start of a defrost programmed on the main is broadcast to the secondary units,
   - from the supervisor, sending the request to the main controller and consequently to the secondary devices,
   - via digital input.
3. Defrost is deactivated:
   - when the defrost measures detects a temperature higher than the end defrost temperature dt1;
   - if there is no defrost probe, or in case the dt1 threshold is not reached, the defrost ends after the maximum time set by parameter dP1.

Caution: for hot gas or heater defrosts, it is especially important for the maximum defrost time to set appropriately, always remembering that the priority is preservation of the stored goods

4. In a main/secondary network with **hot gas defrost**:
   - **there can be no local defrosts** (*)
   - the hot gas valve is always local only (one for each controller)
   - the liquid solenoid valve can be local or shared in the network
   - the suction and equalising valves can be local or shared in the network
   - the end of hot gas defrosts must be synchronised
   - the change from one phase to another is always synchronised between all controllers

Notice: (*) If hot gas ducted defrost is set, care must be taken regarding the possible consequences of localized defrosts carried out by individual units not synchronized with the remaining units in the ducted group.

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
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
dP1	Maximum defrost duration	45	1	240	min	S	YES
r3	End defrost signal by timeout: 0 = disabled; 1 = enabled.	0	0	1	-	M	YES

Defrost at power on (par. d4)

Using parameter d4, it is possible to enable a defrost at power-on; in the case of a main controller, the power-on defrost will be a network defrost, while in the case of a secondary controller, it will be local. The power-on defrost request takes priority over both the control request and the activation of the continuous cycle.

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	YES

Defrost delay (parameter d5)

Using parameter d5, it is possible to set a delay between the enabling or request of the defrost and its actual start.

Notice: the delay is active even when d4 = 0.

Code	Description	Def	Min	Max	UOM	User	User terminal
d5	Defrost delay at power on or (for secondary) after control from main	0	0	240	min	S	YES

For main/secondary networks where the defrost needs to be activated from a digital input on the main, parameter d5 can be used to delay the various defrosts, thus avoiding current overloads.

Pump down phase duration (par. dH1)

Pump down is the phase at the beginning of the defrost cycle during which the evaporator is emptied of refrigerant liquid. Parameter dH1 defines the duration of the pump down phase for each type of defrost cycle.

Code	Description	Def	Min	Max	UOM	User	User terminal
dH1	Pump down duration (0 = pump down disabled)	0	0	999	s	S	YES

Caution: the controller is not equipped with two separate outputs to manage compressor and solenoid. Using parameter DOn, it is possible to select the digital output for the liquid valve required during the pump down phase.

Drip time after defrost (par. dd)

Using parameter dd, it is possible to set the stop time for the compressor/solenoid and the evaporator fans after a defrost, in order to allow proper dripping from the evaporator. If dd = 0, the drip phase is not activated.

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

Post-dripping time (par. Fd)

Using parameter Fd, it is possible to set the post-dripping time, during which control resumes and the evaporator fans operate according to the setting of parameter Fpd. If Fd = 0, the post-dripping phase is not enabled.

Code	Description	Def	Min	Max	UOM	User	User terminal
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	YES
Fpd	Evaporator fans during post-dripping: 0 = On, 1 = Off	1	0	1	-	S	NO

Valve positioning during defrost (par. dSb)

A fixed position (as a percentage) can be set for valve opening throughout the defrost procedure, from the end of pump-down to the start of the dripping phase. The valve will behave as defined by parameters cP1 and Pdd starting from the post-dripping phase. The opening percentage is applied in all the types of defrost. The function is activated by setting parameter dSb to a value between 1 and 100; this value indicates the position of the valve as a % of the number of steps (not capacity). Setting the parameter to 1, the valve is closed completely during defrost. Setting the parameter to 0, positioning is disabled and the valve will behave as defined for the type of defrost selected.

Code	Description	Def	Min	Max	UOM	User	User terminal
dSb	Valve position during defrosts 0: according to the set type of defrost 1: forced closed 2-100: percentage opening	0	0	100	%	S	YES

"Running Time" defrost (par. d10 and d11)

Running Time is a function that allows the system to determine when the refrigeration unit requires a defrost. Specifically, it assumes that if the temperature of the evaporator, as detected by the Sd probe, remains consistently below the threshold set via parameter d11 for a time period defined by parameter d10, there is a likelihood that the evaporator is frozen, and therefore a defrost is requested. The time counter is reset if the temperature rises above the threshold.

Code	Description	Def	Min	Max	UOM	User	User terminal
d10	Defrost time in running time mode (0 = function disabled)	0	0	240	min	S	YES
d11	Defrost temperature threshold in running time mode	-30/ -22	-50/ 58	50/ 122	°C/°F	S	YES
dt1	End defrost temperature (read by Sd)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES
dt2	Secondary evaporator end defrost temperature (read by Sd2)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES

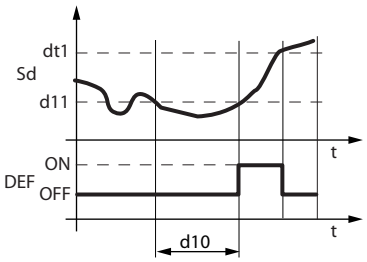


Fig. 6.u

Ref.	Description
Sd	Defrost probe
DEF	Defrost
t	Time

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

This function allows the controller to determine when the refrigeration unit requires a defrost cycle. Specifically, if the difference between two probes set via parameters dd1 and dd2 exceeds a predefined threshold set via parameter dTd for a certain time defined by parameter tdd, the evaporator might be frozen and a defrost cycle is therefore requested.

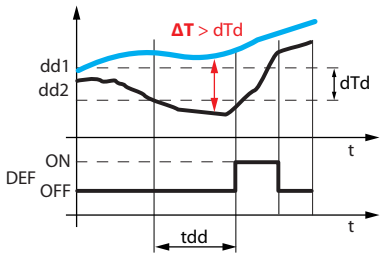


Fig. 6.v

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) - see dEP	0	0	14	-	S	NO
dd2	Assign probe 2 to determine start defrost (dd1-dd2) - see dEP	0	0	14	-	S	NO
dTd	Temperature differential threshold to start defrost	50/ 122	-99.9/ -147.8	99.9/ 211.8	Δ °C/°F	S	NO
tdd	Threshold evaluation time to start defrost	60	15	240	min	S	NO

Pressure probe alarm management during defrost (par. d12)

During defrost and dripping, in order to prevent false alarms from the evaporation pressure probe, it is possible to disable its control. Moreover, for the same purpose, it is also possible to block the probe value update to the supervisor, according to the settings defined in the table for parameter d12.

Code	Description	Def	Min	Max	UOM	User	User terminal
d12	Pressure probe alarm management during defrost	0	0	3	-	S	YES

	probe error	supervisor update
0 =	disabled;	enabled;
1 =	enabled;	enabled;
2 =	disabled;	disabled;
3 =	enabled;	disabled;

Sequential stops (par.dS1, dS2)

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

- OFFTIME: starting from dS1, it is decremented during control stop and held during active control;
- ONTIME: starting from dS2, it is decremented during active control and held during control stop.

Two events may occur, refering to the following figures:

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	YES
dS2	Compressor operating time in sequential stop defrost mode	120	0	240	min	M	YES

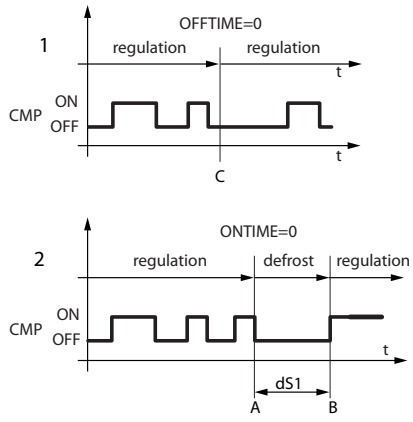


Fig. 6.w

Ref.	Description
CMP	Compressor/ Solenoid
t	Time

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)

This function only has effect for defrosts that end by temperature (par. d0 = 2, 4, 6) if it is enabled by setting parameter d7 =1 . The skip defrost function evaluates whether the defrost duration is less than a certain threshold dn1 (dn2 In case of a second evaporator) and calculated based on parameters dn and dP1 (dP2), and in this case it prevents subsequent defrost cycles.

Code	Description	Def	Min	Max	UOM	User	User terminal
d7	Skip Defrost: 0 = disabled; 1 = enabled.	0	0	1	-	S	YES
dn	Nominal defrost duration for "skip defrost"	75	0	100	%	S	YES
dP1	Maximum defrost duration	45	1	240	min	S	YES
dP2	Maximum secondary evaporator defrost duration	45	1	240	min	S	YES

Thresholds dn1 (evaporator 1) and dn2 (evaporator 2) are defined by:

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

The algorithm keeps a counter of the defrosts to be skipped:

- when the controller is powered on, defrost is performed 7 times without incrementing the counter; from the eighth defrost onwards, the counter is updated;
- if the defrost ends in a time shorter than dn1 (dn2), the skip counter is increased by 1;
- when the counter reaches 1, the next defrost is skipped; if the following defrost also ends in a time shorter than dn1 (dn2), the counter is increased to 2 and the next 2 defrosts are skipped; if the next defrost again ends in a time shorter than dn1 (dn2), the counter is increased to 3 and the following 3 defrosts are skipped. Then, the counter is reset and the algorithm starts again (see 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
Counter	-	-	-	-	-	-	-	1	-	2	-	-	3	-	-	-	1	-	2	-	-	3
Passed defrost?	N	N	N	N	N	N	N	N	S	N	S	S	N	S	S	S	N	S	N	S	S	N
																	Algorithm restart					

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

Notice: the algorithm only applies to scheduled defrosts triggered by time bands or cyclic intervals (par. d1S); manual defrosts or those triggered by a supervision system are always executed and do not affect the counter.

Power Defrost (par. ddt and ddP)

The "Power Defrost" function allows increasing the defrost end threshold set via parameter dt1 (dt2 in case of a second evaporator) and/or the Maximum defrost duration set via parameter dP1 (dP2). These increases allow for more effective defrost cycles. Power Defrost cycles are performed whenever a defrost is requested during night mode or when properly configured via RTC parameters (sub-parameter P of parameters td1…td8), allowing the user to choose the most suitable conditions for this specific procedure. The Power Defrost function is considered active when at least one of the increments set via parameters ddt or ddP is different from zero.

Notice: in Power Defrost, the maximum defrost duration dP1 (dP2) is increased by the value of parameter ddP.

Code	Description	Def	Min	Max	UOM	User	User terminal
ddP	Additional maximum defrost time delta in "power defrost" mode	0	0	60	min	S	YES
ddt	Additional end defrost temperature delta in "power defrost" mode	0	-20/ -36	20/ 36	Δ °C/°F	S	YES
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal; 1 = power defrost.	0	0	1	-	S	NO

6.5 Fan management

MPXPRO allows the management of evaporator and condenser fans with either fixed speed or modulating speed (0…10 VDC or PWM), by providing a proportional signal on the selected analogue output Y1…Y4. In this case, the power supply to the fan must come from the mains or as for fixed-speed fans, while the control signal is provided by the controller output, as shown in the wiring diagrams.

Fixed-speed fans connections

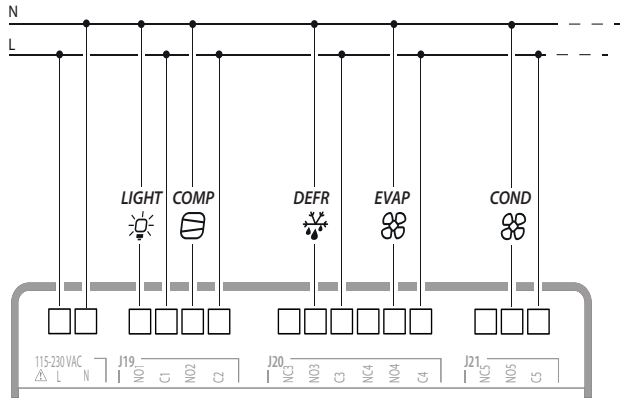


Fig. 6.x

Modulating speed fans connections

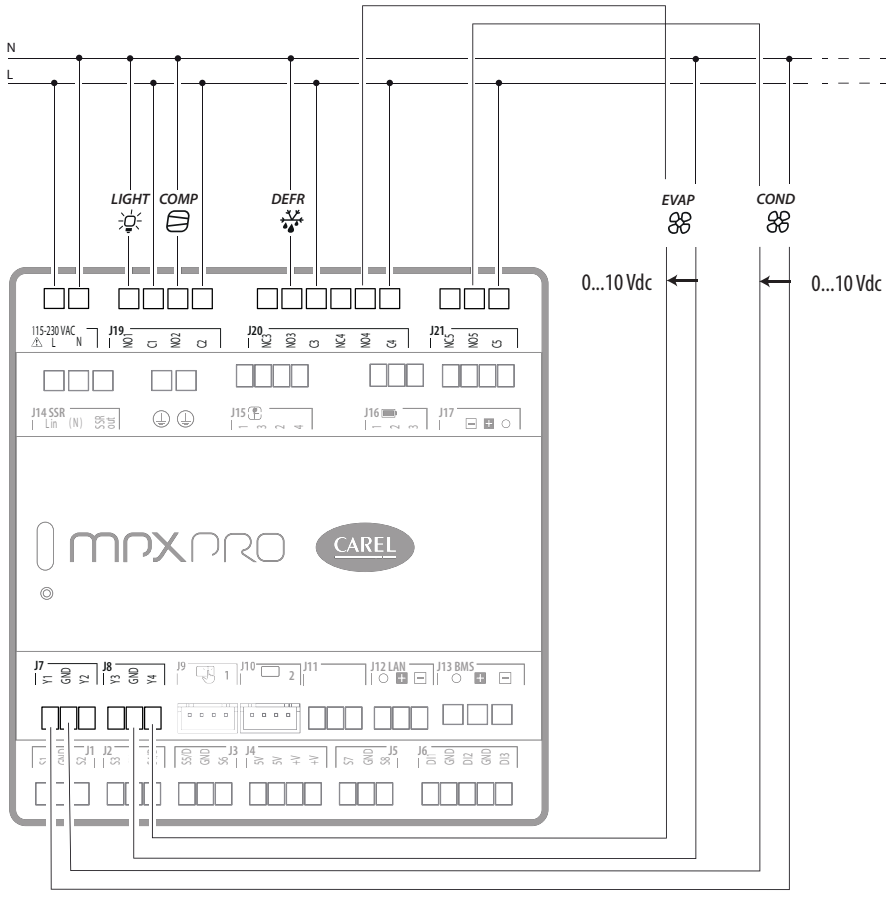


Fig. 6.y

6.5.1 Evaporator fans

The evaporator fans can be always on when the unit is powered, be activated based on the door status, or be managed according to the temperature detected by one or two probes selectable among those connected to the MPXPRO controller, depending on the value set for parameter F0. The switch-off threshold is defined by the value of parameter F1, and the hysteresis by the value of parameter Frd.

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

Parameter Fnd allows setting a fan switch-off delay when switching to night mode. If Fnd = 0, the function is disabled and the fans follow the configured control logic.

Code	Description	Def	Min	Max	UOM	User	User terminal
Fnd	Evaporator fan switch-off time when entering night mode (0 = function disabled)	0	0	240	s	S	NO

Fixed-speed fans

The parameters used to manage fixed-speed fans are shown below (see the connection diagram).

MPXPRO 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) falling below the threshold set for parameter F1;
- F0 = 3 on with door closed (par. DIP > 0)

Code	Description	Def	Min	Max	UOM	User	User terminal
DIP	Assign door contact without control stop digital input - see DIA	0	-1	41	-	S	NO
F0	Evaporator fan management (Sa = first probe, Sb = second probe, par. FSa, FSb): 0 = always on; 1 = activation based on Sa - Sb (see FSa and FSb); 2 = activation based on Sa; 3 = fans on with door closed (door contact configured, par. DIP).	0	0	3	-	S	YES
F1	Evaporator fan activation threshold (only if F0 = 1 or 2)	-5/ 23	-50/ -58	50/ 122	°C/°F	S	YES
Frd	Fan activation differential (including variable speed)	2/ 3.6	0.1	20/ 36	Δ °C/°F	S	YES
FSa	Select first probe for fan control (Sa): 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = evaporation pressure (PEu); 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = ambient humidity (SU); 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu).	2	0	14	-	S	NO
FSb	Second fan control probe - see FSa	13	0	14	-	S	NO

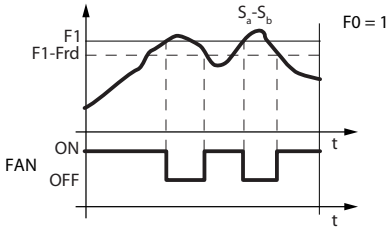


Fig. 6.z

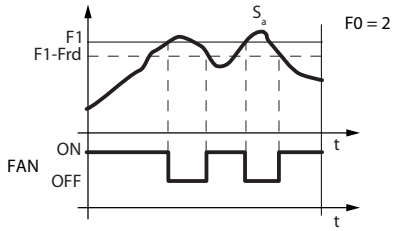


Fig. 6.aa

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

Ref.	Description
Frd	Differential
t	Time
FAN	Evaporator fans

The fans can be turned off in the following situations:

- when the solenoid valve is deactivated (parameter F2);
- during defrosts (parameter F3).

Code	Description	Def	Min	Max	UOM	User	User terminal
F2	Evaporator fans with compressor off: 0 = see F0; 1 = always off.	1	0	1	-	S	YES
F3	Evaporator fans during defrosts: 0 = on; 1 = off.	1	0	1	-	S	YES

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.

Code	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time (fans off) after defrost (0 = no dripping)	2	0	15	min	S	YES
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	YES
Fpd	Evaporator fans during post-dripping: 0 = On, 1 = Off	1	0	1	-	S	NO

Variable-speed fans (EC fans)

MPXPRO can control variable-speed fans, providing a 0-10 Vdc or PWM, proportional signal on output Y1 or Y4, setting by /AE parameter. The signal type can be set via parameter /P6, ..., /P9, corresponding to the selected output.

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); 3 = analogue output 3 (Y3); 4 = analogue output 4 (Y4)	0	0	4	-	S	NO
/P6	Type of analogue output 1 (Y1): 0 = 0-10 V; 1 = PWM 100 Hz; 2 = PWM 2 kHz; 3 = frequency modulation	0	0	3	-	S	YES
/P7	Type of analogue output 2 (Y2) - see /P6	0	0	3	-	S	YES
/P8	Type of analogue output 3 (Y3) - see /P6	0	0	3	-	S	YES
/P9	Type of analogue output 4 (Y4) - see /P6	0	0	3	-	S	YES

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/ 90	F1	50/ 90	Δ °C/°F	S	YES
F6	Maximum evaporator fan speed	100	F7	100	%	S	YES
F7	Minimum evaporator fan speed	0	0	F6	%	S	YES

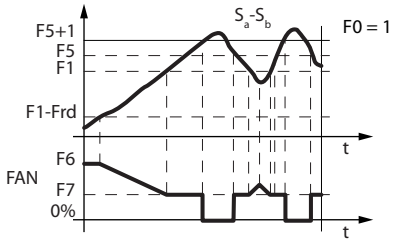


Fig. 6.ab

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

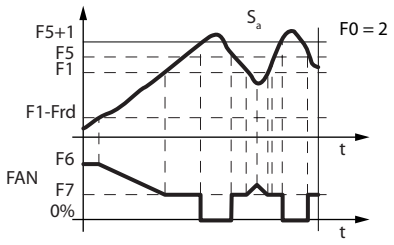


Fig. 6.ac

Ref.	Description
Frd	Differential
t	Time
FAN	Evaporator fans

The maximum and minimum fan speed can be set using advanced parameters F6 and F7. Parameter F6 represents the maximum fan speed, expressed as a percentage of the output command. In the case of a 0…10 V output, it represents the output voltage percentage at maximum speed. Similarly, the minimum speed is set via parameter F7.

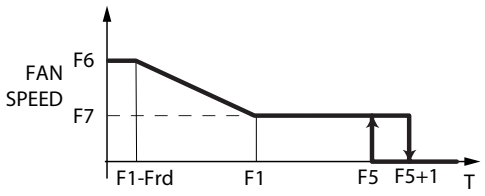


Fig. 6.ad

Ref.	Description
T	Temperature
FAN SPEED	Modulating evaporator fan output

Parameter F8 allows setting the fan boost time, during which the fan runs at maximum speed (par. F6) at startup to overcome the motor's mechanical inertia. If the fan operates too long at low speed, ice may form on the blades; to prevent this, at intervals defined by parameter F10, the fan is forced to run at maximum speed (par. F6) for a time equal to parameter F8.

Code	Description	Def	Min	Max	UOM	User	User terminal
F8	Evaporator fan start-up time (0 = function disabled)	0	0	240	s	S	YES
F10	Evaporator fan time forced at max speed (0 = function disabled)	0	0	240	min	S	YES

6.5.2 Evaporator fan modulation based on cabinet status

MPXone can control variable-speed fans, providing a 0-10 Vdc signal on output Y1 or Y2. The amplitude of the signal can be related to unit status.

Notice: this function is only available on models with analogue outputs (Y1, Y2).

The function is activated by setting parameter FSP_EN, and allows a different speed to be set for each recognised cabinet status.

Code	Description	Def	Min	Max	UOM	User	User terminal
FSP_EN	Enable function for fan control based on unit status	F	F	T	-	S	NO
FSP_A	Evap fan speed with generic alarm	-1	-1	100	%	S	NO
FSP_DA	Evap fan speed with door open alarm	-1	-1	100	%	S	NO
FSP_DFR	Evaporator fan speed during defrost	-1	-1	100	%	S	NO
FSP_F0	Evap fan speed in normal control (F0=0)	-1	-1	100	%	S	NO
FSP_F2	Evap fan speed with control paused (F2=False)	-1	-1	100	%	S	NO
FSP_PD	Evap fan speed during post dripping	-1	-1	100	%	S	NO
FSP_PID	Evaporator fan speed with door open (DIP<>0)	-1	-1	100	%	S	NO
F0	Evaporator fan management 0= always on 1= Sa-Sb 2= Sa 3= fans on with door closed (DIP<>0)	0	0	3	-	S	NO
F2	Evaporator fan status with compressor OFF	T	F	T	-	S	NO
DIP	Assign channel for door open switch for fans ON 0= not configured 1-5 select digital input ID1-ID5	0	0	5	-	S	NO

Example:

If FSP_EN = 1 and all other FSP_xx = -1, the fans operate as normal, the same as with FSP_EN = 0 (0% if off, 100% if on). If setting only FSP_DA, keeping FSP_EN = 1, the fan speed changes only for the door alarm, while in all other states the fans operate as normal.

6.5.3 Condenser fans

MPXPRO allows integrated management of condenser fans, either fixed-speed or variable-speed 0…10 VDC or PWM. Configuration is carried out using the parameters shown in the table.

Code	Description	Def	Min	Max	UOM	User	User terminal
/AE	Assign analogue output for modulating condenser fans - see /AA	0	0	4	-	S	NO
/Fo	Assign condenser fan control probe (Sc) - see /FA	0	-4	8	-	S	YES
DOt	Assign condenser fan digital output - see DOA	0	0	6/7	-	S	NO
F00	Condenser fan management: 0 = always on with compressor on; 1 = activation based on Sc, off with compressor off.	0	0	1	-	S	NO
F4	Condenser fan deactivation temperature	40/ 104	-50/ -58	200/ 392	°C/°F	S	NO
F5d	Condenser fan activation differential	5/ 9	0.1	60/ 108	Δ °C/°F	S	NO
FCC	Modulating condenser fan cut-off temperature	2/ 35.6	0/ 32	50/ 122	°C/°F	S	NO
FCL	Modulating condenser fan maximum outlet value	0	0	100	%	S	NO
FCH	Modulating condenser fan minimum outlet value	100	0	100	%	S	NO

Fixed-speed condenser fans

To activate the function, simply assign a relay output to the condenser fan (par. DOt > 0).
To link activation to a temperature, the condensation probe must be configured (par. /Fo<>0).

If parameter F00 = 0, the condenser fans are on when the compressor is on, regardless of the condensing temperature.

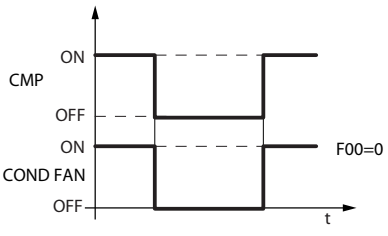
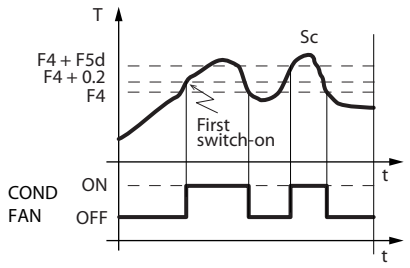


Fig. 6.ae

Ref.	Description
t	Time
CMP	Compressor/ Solenoid
COND FAN	Condenser fans

If parameter F00 = 1, the condenser fans are on/off based on the condensing temperature. When the compressor is first started, the condenser fan will start at F4+0.2 °C (0.36°F) degrees to compensate for rapid increases in temperature that the probe reading cannot react to. Subsequently, the fan switches on and off at F4 + F5d and F4.



Ref.	Description
t	Time
T	Temperature
COND FAN	Condenser fans

Fig. 6.af

Notice: in any case, fans can only start if the compressor/solenoid is ON

Variable-speed condenser fans (EC fans)

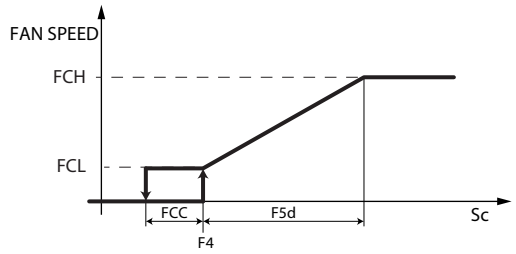
To activate the functional, simply assign an analogue output to the variable speed condenser fan function using parameter /AE and configure the condenser probe using parameter /Fo. The signal type can be set using parameter /P6, ..., /P9 corresponding to the selected output.

Code	Description	Def	Min	Max	UOM	User	User terminal
/P6	Type of analogue output 1 (Y1): 0 = 0-10 V; 1 = PWM 100 Hz; 2 = PWM 2 kHz; 3 = frequency modulation.	0	0	3	-	S	YES
/P7	Type of analogue output 2 (Y2) - see /P6	0	0	3	-	S	YES
/P8	Type of analogue output 3 (Y3) - see /P6	0	0	3	-	S	YES
/P9	Type of analogue output 4 (Y4) - see /P6	0	0	3	-	S	YES
FCC	Modulating condenser fan cut-off temperature	2/ 35.6	0/ 32	50/ 122	°C/°F	S	NO
FCH	Modulating condenser fan maximum outlet value	100	0	100	%	S	NO
FCL	Modulating condenser fan minimum outlet value	0	0	100	%	S	NO

It is possible to set the maximum and minimum fan speeds using parameters FCH and FCL. Parameter FCH represents the maximum fan speed, expressed as a percentage of the output command. In the case of a 0…10V output, it corresponds to the output voltage percentage at maximum speed. Similarly, the minimum speed is set via parameter FCL.

Within the modulation range, the fan speed varies proportionally.
For example, if Sc = F4 + F5d/2, the output corresponds to the percentage (FCH + FCL)/2.

When the fan speed regulator is used, parameter F4 represents the temperature above which the fans are activated, with a hysteresis defined by the value set via parameter FCC for switch-off.



Ref.	Description
Sc	Condensing temperature
FAN SPEED	Modulating evaporator fan output

Fig. 6.ag

Notice: regardless of other conditions, the fans can only turn on if the compressor is ON.

Caution: if defrost is configured in hot gas mode, the fans are turned off even while defrost is in progress.

6.6 Anti-sweat heater or fan modulation

The control of anti-sweat heaters or fans is based on the comparison between the dew point (dew point), calculated from temperature and ambient humidity, and the glass temperature of the display case, measured by a probe or estimated using the supply, return, and ambient temperatures of the refrigerated cabinet.

Code	Description	Def	Min	Max	UOM	User	User terminal
/Ac	Assign analogue output for modulating anti-sweat heaters - see /AA	0	0	4	-	S	NO
DOQ	Assign anti-sweat heater digital output - see DOA	0	0	6/7	-	S	NO
rHd	Anti-sweat heater modulation differential	0	0	20/ 36	Δ °C/°F	S	YES
rHt	Manual anti-sweat heater activation period (0 = function disabled)	5	0	180	min	S	YES

The control of anti-sweat heaters in MPXPRO can be of two types:
- PI (proportional + integral);
- fixed activation (for manual control).

The activation conditions for the algorithms are as follows:

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

PI control

Inputs

The ambient humidity (SU) and temperature (SA) probes can be (*):

- connected to the main (see parameters /FI, /FL, /Fn, /UL, /LL), which automatically shares them with the secondary devices (see "Probe" section);
- connected locally to each controller;
- sent from the supervisor via the serial probes.

Code	Description	Def	Min	Max	UOM	User	User terminal
/FI	Assign ambient temperature probe (SA) - see /FA. For the secondary, if /FI = 0 the value is shared with the main.	0	-4	8	-	S	YES
/FL	Assign ambient humidity probe (SU) - see /FA. For the secondary, if /FL = 0 the value is shared with the main.	0	-4	8	-	S	YES
/FM	Assign glass temperature probe (Svt) - see /FA	0	-4	8	-	S	YES
/Fn	Assign dewpoint value (SdP) - see /FA. For the secondary, if /Fn = 0 the value is shared with the main.	0	-4	0	-	S	YES
/LL	Minimum value for ambient humidity probe (SU)	10	10	/UL	%rH	S	YES
/UL	Maximum value for ambient humidity probe (SU)	100	/LL	100	%rH	S	YES

The glass probe Svt can be connected directly to each controller (see parameter /FM), or it can be estimated. The glass probe estimation is performed internally when the following are available: ambient temperature SA, return temperature Sr, and supply temperature Sm. It is calculated based on parameters rHA, rHb, and rHS according to the following formula:

$$Svt = (SA - rHA) - rHb/100*(SA - rHA - Svirt)$$

where:

$$Svirt =(Sm*(100 - rHS) + Sr*rHS)/100$$

Code	Description	Def	Min	Max	UOM	User	User terminal
rHA	Coefficient A for glass temperature probe estimate	2/ 3.6	-20/ -36	20/ 36	Δ °C/°F	S	YES
rHb	Coefficient B for glass temperature probe estimate	22	0	100	-	S	YES
rHS	Virtual probe composition for glass temperature probe estimate: 0 = outlet probe (Sm); 100 = intake probe (Sr).	20	0	100	%	S	YES

PI control stops working if:

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

Tab. 12.a

If PI control stops working, fixed activation control takes over if enabled (rHt>0)

Outputs

The output value for the anti-sweat heaters or fans depends on the difference between the calculated dew point and the value of the glass probe, on the offset value set by parameter rHo, and on the differential value set by parameter rHd, as shown in the following figure:

Code	Description	Def	Min	Max	UOM	User	User terminal
rHo	Anti-sweat heater modulation offset	2/ 3.6	-20/ -36	20/ 36	Δ °C/°F	S	YES
rHd	Anti-sweat heater modulation differential	0	0	20/ 36	Δ °C/°F	S	YES

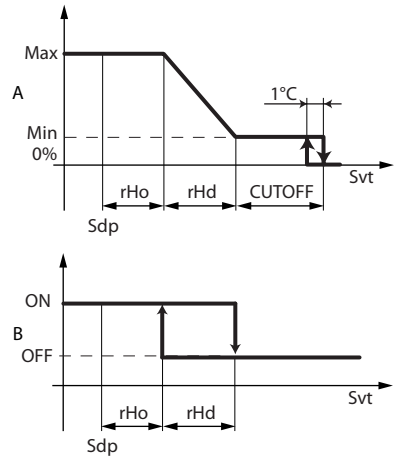


Fig. 6.ah

Ref.	Description
SdP	Dew point
Svt	Glass probe
Min	Minimum output anti-sweat
Max	Maximum output anti-sweat
A	Modulating output (par. /Ac)
B	On/Off output (par. DOQ)

The set point is equal to the dew point Sdp + rHo. The CUTOFF is a fixed value of 5 °C, and the hysteresis is 1 °C.
The minimum and maximum outputs are fixed at 10% and 100%, respectively.

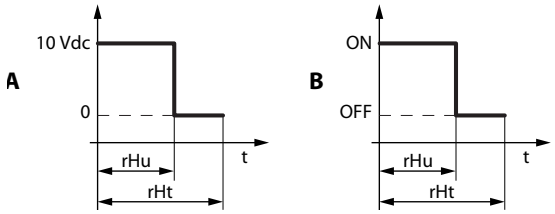
If the glass probe Svt is estimated, the control action is proportional only; if the glass probe Svt is physically present, the control action is proportional + integral, with a constant integral time Tint of 600 s.

Caution: if the serial probes from the supervisor are used for sending the ambient temperature and humidity values, MPXPRO 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
rHu	Anti-sweat heater manual activation percentage in period 'rHt' (0 = function disabled)	70	0	100	%	S	YES
rHt	Manual anti-sweat heater activation period (0 = function disabled)	5	0	180	min	S	YES



Ref.	Description
A	Modulating output (par. /Ac)
B	On/Off output (par. DOQ)
rHu	Anti-sweat heater manual activation percentage
rHt	Manual anti-sweat heater activation period
t	Time

Fig. 6.ai

Notice:
- ON-OFF output on Y1...Y4 (0..10Vdc)
- the anti-sweat heaters are enabled only if the high temperature alarm HI is not active (see the "Temperature Alarms" section).

6.7 Electronic valve

Introduction

MPXPRO can directly manage a CAREL bipolar electronic expansion valve or, alternatively, a PWM valve. See the chapter "Models and Accessories" and the sections "CAREL EXV Valve Connection" and "PWM Valve Connection." Additionally, a 0...10 VDC output can be used as a feedback signal for the control demand sent to the valve (par. /Ab).

The following can be set:
- superheat set point;
- type of refrigerant;
- protectors - low superheat (LowSH), maximum evaporation pressure (MOP), minimum evaporation pressure (LOP).

Code	Description	Def	Min	Max	UOM	User	User terminal
P1	Electronic valve type: 0 = not used/thermostatic valve; 1 = PWM valve (connected to terminal J14 SSR); 2 = Carel bipolar valve E2V, E3V (connected to terminal J15); 3 = 0-10V modulation for refrigerant flow control 4 = PWM valve modulation for refrigerant flow control 5 = Carel E2V/E3V valve modulation for refrigerant flow control 7 = Carel E4V..E7V valve modulation for refrigerant flow control 8 = 0-10 V modulation	2	0	6	-	M	YES

MPXPRO has been designed to manage one electronic expansion valve on one evaporator.

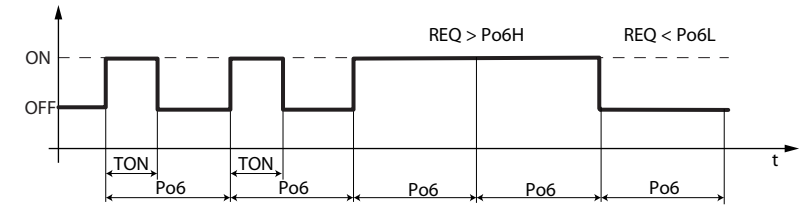
Notice:
- see "Introduction" for the models of temperature and pressure probes to be installed;
- CAREL suggests using ratiometric probes to read the evaporation pressure, which is automatically converted to saturated temperature based on specific tables for the type of refrigerant used.

Caution: in the event of a power failure, models with an integrated ultracap allow emergency closing of Carel bipolar stepper valves up to size E3V.¶

PWM valve (par. Po6, Po6H e Po6L)

To correctly configure PWM valve management, the modulation period must be set using parameter Po6, and the two percentage values below which the valve is considered closed or fully open must be defined using parameters Po6L and Po6H.

Code	Description	Def	Min	Max	UOM	User	User terminal
Po6	PWM valve modulation period	6	0	20	s	S	YES
Po6l	Threshold % below which the PWM valve output is always OFF	10	0	100	%	S	NO
Po6H	Threshold % above which the PWM valve output is always ON	95	0	100	%	S	NO



Ref.	Description
TON	Open time
REQ	Open request

Fig. 6.aj

The valve opening time within the period set by Po6 corresponds to the percentage of the control demand; if the percentage exceeds the value set by Po6H, the valve remains fully open, while if it is lower than the value set by Po6L, the valve remains fully closed. The calculation of the control demand is described below.

Superheat calculation

Using parameters /Fd and /FE, it is possible to assign the measurement of the superheated gas temperature at the evaporator outlet (tGS) and the evaporation pressure (PEu) to the selected probes. The evaporation pressure measurement is then used by the MPXPRO controller to calculate the saturated evaporation temperature (tEu).

Code	Description	Def	Min	Max	UOM	User	User terminal
/Fd	Assign superheated gas temperature probe (tGS) - see /FA	4	-4	8	-	S	YES
/FE	Assign saturated evaporation pressure/temperature probe (PEu/tEu) - see /FA. For the secondary, if /FE = 0 the value is shared with the main.	6	-4	8	-	S	YES
/LE	Minimum value for saturated evaporation pressure/temperature probe (PEu/tEu)	-1/ -14.5	-1/ -14.5	/UE	barg/ psig	M	NO
/UE	Maximum value for saturated evaporation pressure/temperature probe (PEu/tEu)	60/ 870.2	/LE	200/ 2900.7 (*)	barg/ psig	M	NO

(*) It may not be displayed correctly on the 7-segment display, whose display range is -999/999.

From the values tGS = superheated gas temperature and tEu = saturated evaporation temperature derived from pressure, the superheat (SH) is calculated as follows:

$$SH = tGS - tEu$$

MPXPRO manages the proportional opening of the electronic expansion valves, regulating the refrigerant flow inside the evaporator to maintain the superheat value close to the superheat set point defined via parameter P3. The valve opening control operates independently of the normal temperature control of the load.

When the controller requests cooling (the compressor solenoid relay is activated), the electronic valve control is also enabled. If the superheat value detected by the probes is higher than the set point, the valve opens proportionally to the difference between the two values. The variation speed and the opening percentage depend on the configured PID parameters. The valve opening is continuously modulated based on the superheat value using PID control.

Notice: all references related to valve opening control refer to a CAREL bipolar electronic expansion valve. Descriptions are therefore based on the stepper motor characteristic of this type of valve, with 480 opening steps.

Refrigerant type (par. PH)

This is used to set the type of refrigerant used in the system. The table below shows the possible types of refrigerant and the associated values of PH. Contact CAREL if installing E2V valves in systems that use refrigerants not listed in the table.

Code	Description	Def	Min	Max	UOM	User	User terminal
PH	Type of refrigerant used in the unit:	11	0	47	-	M	YES

0: Custom	10: R717	20: R427A	30: R170	40: R454B
1: R22	11: R744	21: R245Fa	31: R442A	41: R458A
2: R134a	12: R728	22: R407F	32: R447A	42: R407H
3: R404A	13: R1270	23: R32	33: R448A	43: R454A
4: R407C	14: R417A	24: HTR01	34: R449A	44: R454C
5: R410A	15: R422D	25: HTR02	35: R450A	45: R470A
6: R507A	16: R413A	26: R23	36: R452A	46: R515B
7: R290	17: R422A	27: HFO1234yf	37: R508B	47: R466A
8: R600	18: R423A	28: HFO1234ze	38: R452B	
9: R600a	19: R407A	29: R455A	39: R513A	

Caution: : if the type of refrigerant is incorrect, the superheat measurement will be wrong, with the risk of liquid returning to the compressor.

In addition, a temperature/pressure conversion curve corresponding to an arbitrary new refrigerant can be entered (custom gas) by writing from the supervisor suitable coefficients, a numeric ID for the gas and the CRC protection value. The coefficients are provided by CAREL. Once the new refrigerant has been entered, it will be available by setting parameter PH to 0. The value 0 can only be applied if the cyclic redundancy check (CRC) does not detect errors. If the coefficients are modified after having chosen

to use a custom refrigerant (PH = 0) and the CRC check fails, alarm GPE will be displayed on the user interface and control will stop.

Superheat set point (parameter P3)

The parameter that electronic valve control is based on is superheat, which effectively tells whether or not there is liquid at the evaporator outlet.

Code	Description	Def	Min	Max	UOM	User	User terminal
P3	Superheat set point	10	0	25	K	S	YES

SH = tGS - tEu	SH = superheat (K) tGS = superheated gas temperature (°C/°F); tEu = saturated evaporation temperature, converted from the pressure (°C/°F).

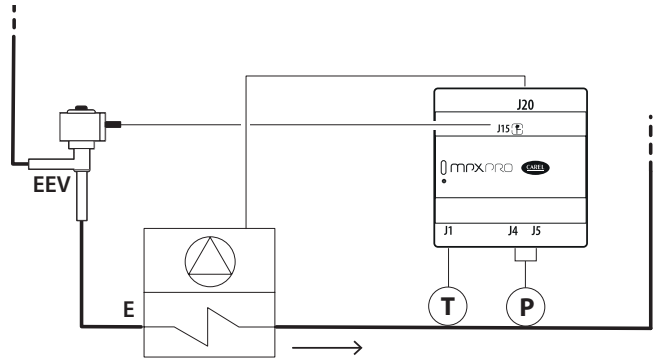
If superheat is high it means that the evaporation process is completed well before the evaporator outlet, and therefore flow-rate of refrigerant through the valve is insufficient. This causes a reduction in cooling efficiency due to the failure to exploit part of the evaporator.

Vice-versa, if superheat is low, it means the evaporation process does not end at the evaporator outlet and some amount of liquid is still present at the compressor suction. In this case, the valve opening must be reduced.

The superheat working range has a lower limit: if the flow through the valve is excessive, the measured superheat will be close to 0 K. This implies the presence of liquid, even though its actual proportion relative to the gas cannot be quantified, and therefore poses a potential risk for the compressor. On the other hand, high superheat, as previously mentioned, indicates an insufficient refrigerant flow. Superheat must therefore always be greater than 0 K and have a minimum stable value allowed by the valve-unit system.

A low superheat value also corresponds to a potentially unstable condition, as the turbulent phase of evaporation may occur near the probe measurement point. For this reason, the expansion valve control must operate with high precision and fast response capability around the set point configured via parameter P3.

Notice: the parameters SH, tGS, tEu, and PPU (valve opening percentage) are read-only variables, useful for monitoring the refrigeration process.



Ref.	Description
T	Superheated gas temperature
E	Forced-air evaporator
EEV	Electronic expansion valve
P	Evaporation pressure

Fig. 6.ak

MPXPRO, with PID control, tends to maintain the actual superheat, calculated based on the probe readings, around the value set for P3 parameter. This is done by gradually varying the opening of the electronic valve on the difference between the actual superheat and the set point.

Caution: the measured superheat value depends on the quality of the installation, the positioning of the probes and other factors. Depending on the specific installation, the superheat set point may differ from the actual value. Set point values that are too low (2 to 3 K), albeit ideally usable, may cause problems involving the return of liquid refrigerant to the compressor.

Notice: for the advanced dynamic set point function, see the next section.

Initial valve position when control starts (parameter cP1)

This is used to set the position of the valve as a percentage when control starts. High values ensure intense and immediate cooling of the evaporator when each request is sent, however may cause problems if the valve is oversized with reference to the unit's cooling capacity. Low values, on the other hand, allow a more gradual and slower action. The setting value is for 5 seconds maintained.

Code	Description	Def	Min	Max	UOM	User	User terminal
cP1	Initial valve position when control starts	30	0	100	%	S	YES

Initial valve position maintenance time after defrost (parameter Pdd)

At the end of a defrost, during the dripping phase, the expansion valve can be forced open to the initial value set for cP1 for a time equal to Pdd. This avoids excessive opening of the valve due to the temporarily high evaporator temperatures.

Code	Description	Def	Min	Max	UOM	User	User terminal
Pdd	Initial valve position maintenance time after defrost	10	0	30	min	M	YES

Support saturated temperature for pressure probe error (parameter P15)

In the event of a pressure/saturated evaporation temperature probe error, this represents the constant value used by the device to simulate the probe reading. In centralised systems, the evaporation pressure is determined by the compressor rack set point. Once this set point has been set for P15, control can continue, even if not in perfect conditions, in emergency situations.

Code	Description	Def	Min	Max	UOM	User	User terminal
P15	Support saturated temperature for pressure probe error	-15/ 5	-50/ -58	50/ 122	°C/°F	S	YES

PID control (parameters P4, P5, P6)

The opening of the electronic valve is controlled based on the difference between the superheat set point and the actual superheat calculated by the probes. The speed of variation, reactivity and the ability to reach the set point depend on three parameters:

- Kp = proportional gain, parameter P4;
- Ti = integral time, parameter P5;
- Td = derivative time, parameter P6.

The ideal values to be set vary depending on the applications and the utilities managed, nonetheless default values are proposed that allow good control in the majority of cases.

For further details, refer to classic PID control theory.

Code	Description	Def	Min	Max	UOM	User	User terminal
P4	Proportional gain	15	0	100	-	M	YES
P5	Integral time 0 = function disabled	150	0	900	s	M	YES
P6	Derivative time 0 = function disabled	5	0	100	s	M	YES

P4: this represents the amplification factor. Its action is directly proportional to the variation in superheat. It acts on the speed of the valve, in terms of steps/°C. The valve moves P4 steps for every degree centigrade variation in superheat, opening or closing whenever the superheat value increases or decreases respectively. It also acts on the other control factors, and is valid in both normal control and with all emergency control functions.

- High values ==> fast and reactive valve (e.g. 20);
- Low values ==> slow and less reactive valve.

P5: this represents the time required by the controller to balance the difference between the set point and the actual superheat. In practical terms it limits the number of steps that the valve completes each second. It is only valid during normal control, the special functions in fact have their own integral time.

- High values==> slow and less reactive valve (e.g. 400);
- Low values ==> fast and reactive valve;
- P5 = 0 ==> integral action disabled.

P6: this represents the reaction of the valve to variations in superheat. It amplifies or reduces variations in superheat.

- High values ==> rapid variations;
- Low values ==> limited variations;
- P6 = 0 ==> derivative action disabled.

"Smooth Lines" function (par. PSM)

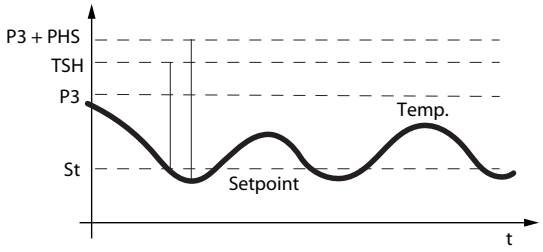
The smooth lines function optimises evaporator capacity based on actual cooling demand, allowing more effective and stable control of the showcase. The function completely eliminates traditional on/off control cycles, modulating the temperature exclusively using the electronic valve; superheat set point is controlled through a precise PI control algorithm based on the desired preservation temperature.

The main features are:

- the superheat set point for managing the electronic expansion valve can vary between a minimum (traditional set point P3) and maximum limit (P3 + PHS: max. offset) using PI control (pre-configured), based on the control temperature and how far this is from the corresponding set point St;
- the temperature inside the showcase can fall slightly below the set point St, without stopping the main control, however simply closing the electronic valve. Parameter PLt allows setting the permitted offset value below the set point.
- the compressor/solenoid relay remains active at all times, while the electronic expansion valve modulates the flow of refrigerant into the evaporator;
- it is easy to use, as it is the controller itself that automatically adapts control based on current operation, without requiring special parameter settings.

Notice: the PI control used to calculate the superheat set point is preset; however, it can be optimized using parameters PSd and PSI.

The main effects are:
- no swings in temperature and superheat due to the set point being reached;
- stable temperature and superheat control;
- when the control temperature reaches the temperature set point (St), the superheat set point (P3) is increased by the value set for parameter THS (P3+THS);
- maximum energy savings due to load stabilisation;
- lower dehumidification effect and stable air temperature around the food.



Ref.	Description
t	Time
SH set	Superheat set point
Temp.	Cabinet temperature

Fig. 6.al

Code	Description	Def	Min	Max	UOM	User	User terminal
PSM	Smooth lines, enable function 0 = disabled; 1 = enabled.	0	0	1	-	M	YES
PLt	Smooth lines, offset to stop control below set point	2/ 3.6	0	10/ 18	Δ °C/°F	M	YES
PHS	Smooth lines, maximum superheat offset	15	0	50	K	M	YES
PSd	Control derivative time (smooth lines or liquid control)	0	0	100	s	M	YES
PSI	Control integral time (smooth lines or liquid control)	150	0	800	s	M	YES
TSH	Smooth lines, superheat threshold	0	0	5	K	M	YES

Notice:
- if the Smooth Lines function is enabled on MPXPRO controllers, the floating suction plug-in on the supervision system must be properly configured, considering this function as active.
- if the control probe fails and the Duty Setting is activated, the Smooth Lines function is disabled.

Manual valve positioning (par. PMP and PMu)

Parameter PMP allows enabling/disabling manual valve positioning:
- PMP = 0: manual positioning disabled
- PMP = 1: manual positioning enabled

When manual positioning is enabled, parameter PMu allows setting the manual opening percentage of the electronic valve.

Code	Description	Def	Min	Max	UOM	User	User terminal
PMP	Enable manual expansion valve positioning: 0 = disabled; 1 = enabled.	0	0	1	-	S	YES
PMu	Manual valve position	0	0	100	%	S	YES

6.7.1 Variable superheat set point

Under certain stable system conditions, it is possible to lower the superheat set point, achieving energy savings without compromising product preservation. MPXPRO allows the set point to be changed via digital input or from the supervision system, through the functions described below.

Alternative superheat set point via digital input (par. DIV)

The superheat set point can be modified using a digital input configured via parameter DIV. When the digital input is active, the superheat set point and the low superheat alarm threshold take on the values set via parameters P3A and P7d, respectively (see the "Protections" section).

Code	Description	Def	Min	Max	UOM	User	User terminal
DIV	Assign digital input for enabling alternative superheat set point - see DIA	0	-1	41	-	S	NO
P3A	Very Low Superheat, default superheat set point	5	0	25	K	S	NO
P7d	Very Low Superheat, alternative low superheat alarm threshold	5	-10	P3	K	S	NO
rIV	Digital input for enabling alternative superheat set point logic - see rIA	0	0	1	-	S	NO

Caution: when using an alternative set point via virtual input, there is no check to ensure that the serial communication line is actually active.

Dynamic superheat set point "Very low superheat" (par. P3E)

Parameter P3E enables the Very Low SuperHeat (VLSH) function. In this case, the superheat set point becomes a dynamic value received from the supervision system (par. P3d), starting from the default value set via parameter P3A. If communication with the supervision system is lost, the controller regulates based on parameter P3, which in this configuration serves as a safety set point. The low superheat alarm threshold takes the value set via parameter P7d (see the "Protections" section).

To verify communication with the supervision system, the value of parameter SOn is monitored; it must be written by the supervisor within the time defined by parameter SOt. After verification, the SOn value is reset, waiting for a new write from the

supervisor.
For secondary controllers on the local LAN network, parameter P3n allows selecting whether the function is activated locally or by the main, and whether it follows the local set point or the one sent by the main.

Code	Description	Def	Min	Max	UOM	User	User terminal
P3d	Very Low Superheat, dynamic superheat set point	0	0	25	K	S	NO
P3E	Very Low Superheat, enable dynamic superheat set point: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
P3n	Very Low Superheat, superheat set point tracking from main (only for secondary)	1	0	2	-	S	NO
SOn	Heart beat function, value written by supervisor	0	0	1	-	S	NO
SOt	Heart beat function, maximum time between two supervisor writes	90	0	9999	s	S	NO

Notice: if both the alternative set point via digital input and the dynamic Very Low Superheat set point are enabled, the alternative set point takes priority.

DIV digital input	P3E	Superheat set point	Notes
Not active/ Not configured	0	P3	Standard set point
Not active/ Not configured	1	P3d	Very Low Superheat dynamic set point via serial
Active	0	P3A	With digital input enabled, any other set point is ignored
Active	1	P3A	

6.7.2 Refrigerant flow control

This function is used to precisely control the flow of liquid refrigerant via a stepper valve, PWM valve or 0–10 V signal. It is ideal for pumped CO_2 systems, where some cabinets are refrigerated directly by the flow of liquid refrigerant through the evaporator, without gas expansion, ensuring optimal performance and the highest energy efficiency. The function is enabled by setting the value of parameter P1 = 3, 4, 5, 7.

The type of control is the same as currently used for the smooth lines function, however limited to the following variables:

Code	Description	Def	Min	Max	UOM	User	User terminal
P1	Electronic valve type	2	0	8	-	M	SI
rMu	Minimum % opening for refrigerant control	0	0	100	%	M	NO
St	Set point	50/122	r1	r2	°C/°F	S	SI
rd	Differential	2/3.6	0.1	99.9/179.8	Δ °C/°F	S	SI
Sv	Virtual probe value used for control	-	-	-	°C	S	NO
PLt	Smooth lines, offset to stop control below set point	2/3.6	0	10/18	Δ °C/°F	M	SI
PSP	Control proportional coefficient (smooth lines or liquid control)	5	0	100	-	M	NO
PSI	Control integral time (smooth lines or liquid control)	150	0	800	s	M	NO
PSD	Control derivative time (smooth lines or liquid control)	0	0	100	s	M	NO

The last 3 variables in the table are the PID control configuration parameters. The direction of control requires the valve to be opened to counteract the increase in the measured temperature (Sv).
Parameter PLt is used as a cut-off offset: if Sv ≤ (St – PLt) control stops and the valve is closed (0%).
In the event of an error relating to the control temperature probe(s), the valve is closed (0%).
The function features a hysteresis for opening/closing of the valve. The algorithm, configurable via parameter rMu from 0% to 100%, is illustrated in the following figure.

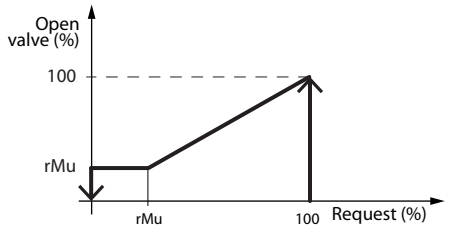


Fig. 6.am

6.7.3 Protection functions

LowSH: low superheat threshold (par. P7)
To prevent too low superheat values that may cause the return of liquid to the compressor or system instability (swings), a low superheat threshold can be defined, below which a special protection function is activated. The LowSH threshold must be lower than the superheat set point. When the superheat falls below the threshold, the system immediately enters low superheat status and activates an integral control action, with the aim of closing the electronic valve more quickly. The low superheat integral time indicates the intensity of the reaction: the lower the value, the more intense the reaction will be. In practice, the intensity of the system's "reaction" is increased. If the device remains in low superheat status for a certain period, a low superheat alarm is activated, with the display showing the message 'LSH', if enabled. The low superheat signal features automatic reset, when the condition is no longer present or the controller is switched off (standby). When low superheat status is activated, the local solenoid valve can be forced closed (parameter P10).

Notice: If either the alternative or dynamic superheat set point is enabled, the low superheat alarm threshold takes the value set via parameter P7d.

Code	Description	Def	Min	Max	UOM	User	User terminal
P7	LowSH, low superheat threshold	5	-10	P3	K	S	YES
P7d	Very Low Superheat, alternative low superheat alarm threshold	5	-10	P3	K	S	NO
P8	LowSH, integral time (0 = function disabled)	15	0	240	s	M	YES
P9	LowSH, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES
P10	Enable close solenoid valve for low superheat (LowSH and/or low suction temperature LSA): 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	YES

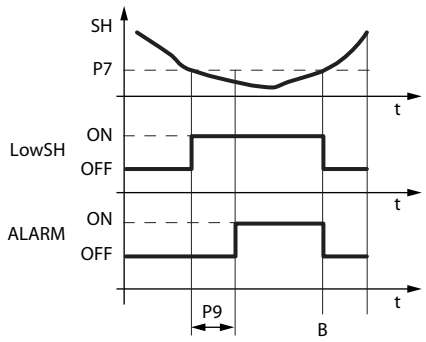


Fig. 6.an

Ref.	Description
SH	Superheat
LowSH	Low superheat protection
ALARM	LSH alarm
t	Time

Notice:

- for main/secondary networks with a shared solenoid and P10=1, if the low superheat alarm occurs on one showcase, the solenoid remains open to ensure correct control of all the other showcases;
- if P10 = 1, the secondary unit that signals the LowSH status not only closes the local solenoid valve but also propagates the request across the local LAN. This enables the closure request to be sent to the main unit over the LAN. To ensure the network solenoid valve is actually closed, the solenoid on the main must be enabled as a network valve (parameter r7 = 1).

MOP: maximum evaporation pressure (par. PM1)

When starting or restarting a system, the compressors may not be able to satisfy the simultaneous cooling requirements of all the units in the system. This may cause an excessive increase in the evaporation pressure and consequently the corresponding saturated temperature. When the evaporation pressure, expressed in saturated temperature (tEu), rises above the threshold set via parameter PM1, the system enters the MOP protection state after a delay defined by parameter PM3. In this state, the controller exits PID control of the superheat and begins to gradually close the valve using an integral action defined by parameter PM2, in order to bring the evaporation pressure back below the set threshold. The protection function has been designed to allow a gradual return to normal operating conditions, that is, when the critical conditions have ended, the controller temporarily operates with a higher superheat set point until the function is automatically reset.

Caution: if this action leads to the complete closure of the electronic valve, the solenoid valve, also the network solenoid, if properly enabled via parameter PM5, is also closed. The alarm signal with the message "MOP" is delayed with respect to the activation of the protection, and it is automatically cleared as soon as the saturated temperature drops below the threshold set via PM1.

Code	Description	Def	Min	Max	UOM	User	User terminal
PM1	MOP, max saturated evaporation temperature threshold	50/ 122	-50/ -58	50/ 122	°C/°F	S	YES
PM2	MOP, integral time (0 = function disabled)	20	0	800	s	M	YES
PM3	MOP, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES
PM5	MOP, enable solenoid valve closing: 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	YES
PM6	MOP, maximum threshold of the superheated gas temperature (tGS) for protection enable	30/ 86	-50/ -58	50/ 122	°C/°F	S	YES

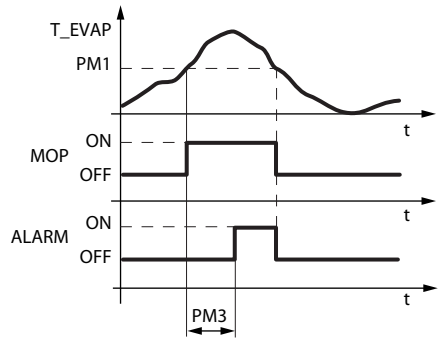


Fig. 6.ao

Ref.	Description
T_EVAP	Evaporation temperature
MOP	MOP protection
ALARM	MOP alarm
t	Time

Parameter PM6 allows setting a threshold for the superheated gas temperature tGS that disables the protection, in order to prevent damage in case a compressor is present.

LSA - Low suction temperature tGS (par. P11)

When the suction temperature tGS falls below the threshold set by the P11 parameter, the alarm is activated after the set delay (established by the P12 parameter), closing the electronic valve by the LSA alarm and the local or network solenoid valve (if parameter P10 = 1). The alarm is reset when the suction temperature exceeds the set threshold plus the hysteresis fixed on 3 °C.

Code	Description	Def	Min	Max	UOM	User	User terminal
P10	Enable close solenoid valve for low superheat (LowSH and/or low suction temperature LSA): 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	YES
P11	LSA, low suction temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
P12	LSA, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES

Notice:

- in a main/secondary network with a shared solenoid and P10 = 1, if the LSA alarm occurs on a main unit, the solenoid remains open to ensure proper control of all other units;
- if P10 = 1, the secondary unit that signals the LSA status not only closes the local solenoid valve but also propagates the closure request across the local LAN. This enables the request to be sent to the main over the LAN. To make the closure of the network solenoid valve effective, the solenoid on the main must be enabled as a network valve (parameter r7 = 1).

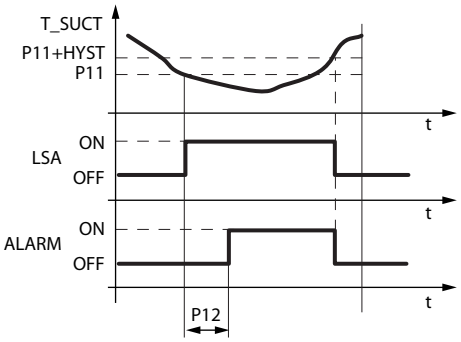


Fig. 6.ap

Ref.	Description
T_SUCT	Suction temperature
HYST	Hysteresis (3°C/°F)
LSA	Protection
ALARM	LSA alarm
t	Time

LOP: Minimum evaporation pressure (par. PL1)

This function is especially useful for stand-alone refrigeration units, helping to prevent the evaporation pressure from remaining excessively low for extended periods. When the evaporation pressure, expressed in saturated temperature tEu, drops below the threshold set via parameter PL1, the LOP protection is activated. This adds a dedicated integral action, characterized by the integral time set via parameter PL2, to the standard PID control, making the response more reactive. The PID control remains active, as it is still necessary to monitor superheat to prevent compressor flooding. The LOP alarm is delayed with respect to the activation of the protection by a time defined by parameter PL3. The alarm clears automatically when the pressure value, in saturated temperature, rises above the PL1 threshold.

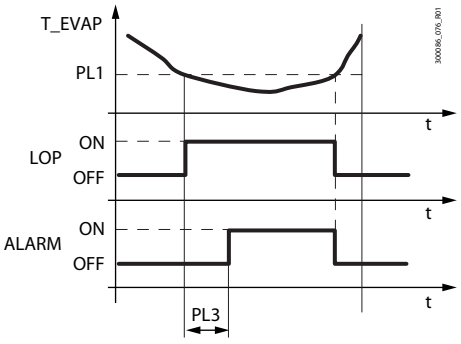


Fig. 6.aq

Ref.	Description
T_EVAP	Evaporation temperature
LOP	LOP Protection
ALARM	LOP Alarm
t	Time

Code	Description	Def	Min	Max	UOM	User	User terminal
PL1	LOP, minimum saturated evaporation temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
PL2	LOP, integral time (0 = function disabled)	0	0	800	s	S	YES
PL3	LOP, alarm delay (0 = alarm disabled)	0	0	240	s	S	YES

6.8 Compressor

MPXPRO features the following compressor protection parameters.

Code	Description	Def	Min	Max	UOM	User	User terminal
c0	Delay to enable solenoid/compressor and evaporator fans at power on	0	0	240	min	M	YES
c1	Min time between consecutive compressor starts	0	0	15	min	M	YES
c2	Minimum compressor OFF time	0	0	15	min	M	YES
c3	Minimum compressor ON time	0	0	15	min	M	YES
d9	Defrost priority over compressor protection times: 0 = compressor protection times observed; 1 = compressor protection times ignored.	1	0	1	-	S	YES

- 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. In models with Carel electronic expansion valve and Ultracap technology, this parameter must be set to a value greater than 2;
- 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;
- parameter c3 sets the minimum compressor on-time before it can be turned off;
- parameter d9 disables compressor protection times in the event of a defrost request: If d9 = 0, the protection times are respected; If d9 = 1, the protection times are ignored and defrost takes priority.

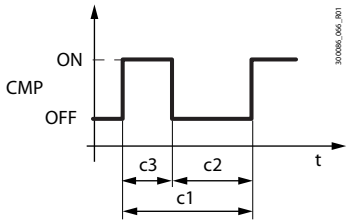


Fig. 6.ar

Ref.	Description
t	Time
CMP	Compressor

Auxiliary compressor management (par. DOk)

A second On/Off-type auxiliary compressor can be managed by configuring the corresponding digital output via parameter DOk. The operation of the two compressors can be set in direct or reverse mode using parameter rC.

Compressor 1 will always be the first to switch on and the last to switch off; rotation management for the second compressor is not provided. Safety timings for compressors 1 and 2 are based on parameters c2, c3, and c4, and are the same for both compressors.

Code	Description	Def	Min	Max	UOM	User	User terminal
c11	Second compressor start delay	4	0	250	s	S	NO
DOk	Assign second ON/OFF compressor digital output - see DOA	0	0	6/7	-	S	NO
rC	Operating mode: 0 = direct; 1 = reverse.	0	0	1	-	S	NO

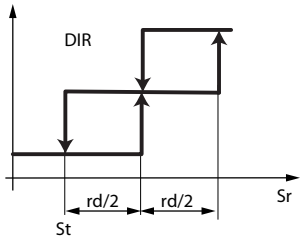


Fig. 6.as

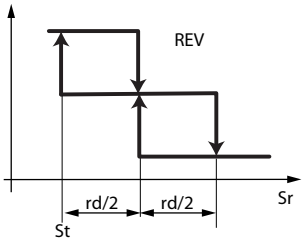


Fig. 6.at

Ref.	Description
Sr	Control probe
DIR	Control direct
REV	Control inverse

Unit periodic maintenance counter (par. HMP e HMc)

The controller allows signalling the need for scheduled maintenance of the unit. This can be configured by setting the operating hours (with control in progress) using parameter HMP and/or the number of operating days using parameter HMc. When either of these thresholds is reached (whichever occurs first), a maintenance request is signalled with the message "SrC" on the HMI user terminal. After maintenance has been performed, the notification can be reset and the next intervention scheduled using parameter HMr.

⚠ **Caution:** the reset operation of the operating hours and the SrC warning is irreversible.

Code	Description	Def	Min	Max	UOM	User	User terminal
HMP	Unit operating hour threshold (in thousands)	0	0	45	h*1000	S	NO
HMr	Reset operating hours and maintenance warnings **(Caution: irreversible operation)**	0	0	1	-	S	NO
HMc	Threshold for number of days until next unit maintenance	0	0	3650	days	S	NO

6.8.1 Variable-capacity compressor (VCC)

MPXPRO can calculate the optimal speed of a variable-speed compressor (VCC) based on the value read from the control probe. The calculated value is sent to a modulating output as a 0…10 V signal or frequency-modulated signal. Using parameter /AG, any of the analogue outputs Y1…Y4 can be selected as the modulating analogue output, with the signal type set via the corresponding parameter /P5…/P8.

Par.	Description	Def	Min	Max	UOM	User	User terminal
/AG	Assign analogue output for modulating compressor - see /AA	0	0	4	-	S	NO
/P6	Type of analogue output 1 (Y1): 0 = 0-10 V; 1 = PWM 100 Hz; 2 = PWM 2 kHz; 3 = frequency modulation.	0	0	3	-	S	YES
/P7	Type of analogue output 2 (Y2) - see /P6	0	0	3	-	S	YES
/P8	Type of analogue output 3 (Y3) - see /P6	0	0	3	-	S	YES
/P9	Type of analogue output 4 (Y4) - see /P6	0	0	3	-	S	YES

VCC with frequency modulation

The output signal provided by MPXPRO is a digital square wave, with a voltage range from 0 to +10 VDC and a frequency range defined as described later. The duty cycle is 50%.

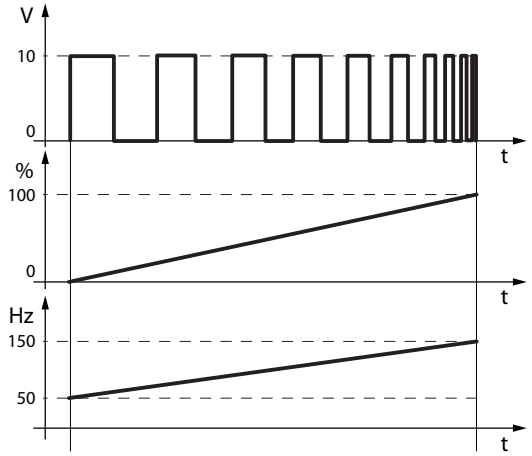


Fig. 6.au

The compressor speed follows the input frequency signal according to a relationship like the one shown in the figure.

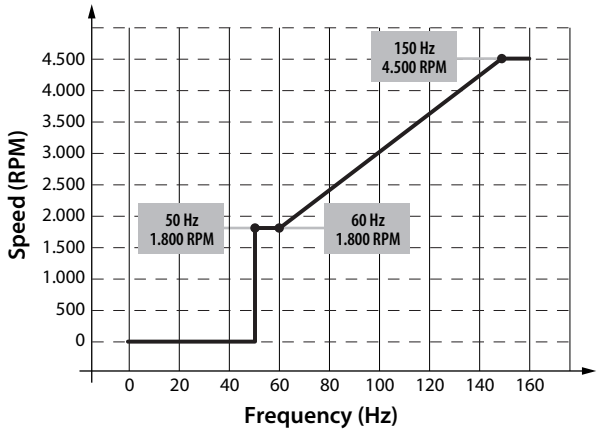


Fig. 6.av

Notice: the reference frequencies and corresponding speeds vary depending on the type of compressor and the parameters set (see below).

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.

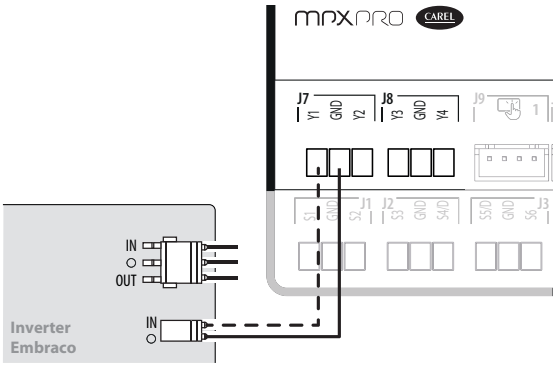


Fig. 6.aw

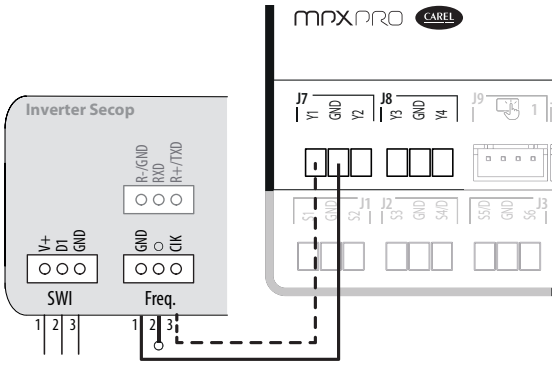


Fig. 6.ax

VCC compressor configuration

All parameters referring to VCC are expressed in Hz. The corresponding compressor rotational speed (RPM) is related to the frequency by the following equation:

Compressor speed (rpm) = Frequency (Hz) cuF

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

Code	Description	Def	Min	Max	UOM	User	User terminal
cMA	VCC compressor frequency for hot gas defrost	150	0	250	Hz	M	YES
cMf	Maximum VCC compressor rotation frequency	100	0	255	Hz	M	YES
cMi	Maximum VCC compressor control frequency	30	0	250	Hz	M	YES
cnf	VCC compressor switch-off frequency	52	0	255	Hz	M	YES
cSc	Minimum VCC compressor control frequency	53	0	255	Hz	M	YES
cSt	VCC compressor soft start time	5	0	240	s	M	NO
cuf	Conversion factor from frequency (Hz) to VCC compressor speed (rpm)	30	0	99.9	-	M	NO

Notice: see the compressor user manual to correctly set the VCC parameters.

Each VCC compressor model operates between two frequency limits: the shutdown frequency and the maximum rotation frequency. MPXPRO uses the following preset values:

- cMi = shutdown frequency = 30 Hz (thermostat signal present, but VCC is stopped, 0 RPM);
- cMA = maximum rotation frequency = 150 Hz (4500 RPM).

To adapt the VCC cooling capacity to the actual needs of the application, the following parameters are used:

- cnf = minimum control frequency; preset value = 52 Hz (1560 RPM);
- cMf = maximum control frequency; preset value = 100 Hz (3000 RPM).

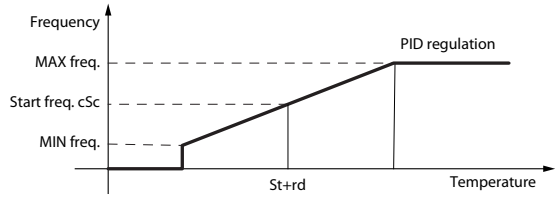
During normal operation, when conditions require the VCC to restart, the compressor runs for a few seconds at the soft-start frequency for the soft-start time.
To adapt this frequency to the VCC's oil recovery specifications, the following parameters are used:

- cSc = soft-start frequency; preset value = 53 Hz (1590 RPM);
- cSt = soft-start time; preset value = 5 s.

VCC compressor control

MPXPRO calculates the VCC compressor speed using a PID-type algorithm. The compressor remains off until the control temperature exceeds the value St + rd; at that point, the compressor starts at the soft-start frequency set via parameter cSc. After the soft-start time, defined by parameter cSt, the PID algorithm manages the appropriate speed within the operating range defined by parameters cnF and cMF.

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



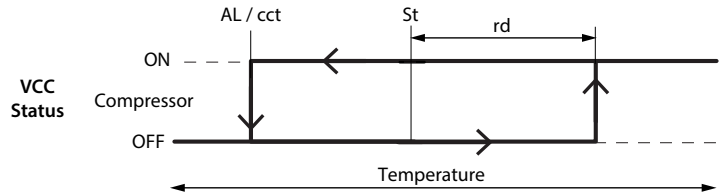
Ref.	Description
Sreq	Control probe
FREQ	Control frequency

Fig. 6.ay

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

The default values are suitable and safe for the initial startup of any application. For any adjustments, it is recommended to modify one parameter at a time and to test the application's behavior in a controlled environment.

If the compressor is running, the control will switch it off when the temperature read by the control probe reaches the low temperature alarm threshold or matches the set point St for a time equal to the value set via the cct parameter:
- if cct is set to 0, the compressor switches off immediately upon reaching St;
- if cct is set to 255, the compressor never switches off.



Ref.	Description
AL / cct	Low temperature threshold or shutdown time reached

Fig. 6.az

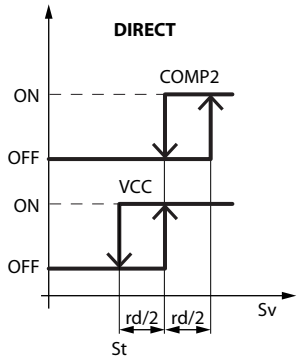
Continuous cycle with VCC compressor

When the continuous cycle is activated, the compressor is switched on (if it is off; otherwise, it remains on). The compressor operates at the speed set via the cMA parameter until the end of the continuous cycle.

Par.	Description	Def.	Min	Max	U.M	User	User terminal
cMA	Maximum VCC compressor rotation frequency	150	0	250	Hz	M	YES

On/Off and VCC compressor

If the auxiliary compressor is configured, the first compressor to be activated is the VCC, and the second compressor to be activated is the On/Off compressor.



Ref.	Description
Sv	Control probe
COMP2	Auxiliary compressor request

Fig. 6.ba

Code	Description	Def	Min	Max	UOM	User	User terminal
c11	Second compressor start delay	4	0	250	s	S	NO
DOk	Assign second ON/OFF compressor digital output - see DOA	0	0	6/7	-	S	NO

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

6.9 Functions associated with current sensors

The 5-relay MPXPRO models (see "Models and accessories") are equipped with current sensors on relays 2, 3 and 4. These measure the instant power (W) and power consumption (kWh) of the connected loads, signalling any malfunctions in the event of relay failures or excessive current draw.

Notice: the sensors measure the current to the loads connected directly to the relays, without any intermediate contactors.

The controller measures the current drawn by the load plus its own power supply voltage, and uses these data to calculate power and hourly consumption.

Notice: current sensors measure the current drawn by the load; for this reason, loads can be connected to any of the available phases, and not necessarily to the same phase that powers the controller.

Code	Description	Def	Min	Max	UOM	User	User terminal
GENERAL PARAMETERS							
ErES	Completely reset progressive consumption data	0	0	1	-	M	NO
Log_h	Periodic log sampling - hours 0=disabled	0	0	23	h	S	NO
Log_m	Periodic log sampling - minutes 0=disabled	0	59	min	S	S	NO
PHYSICAL RELAY PARAMETERS (R2, R3, R4)							
EL2..4	Minimum relay current threshold	0	0	100	A	S	NO
EU2..4	Maximum relay current threshold	0	0	100	A	S	NO
Et2..4	Current sensor alarm delay (0=disabled)	0	0	3600	s	S	NO
EF2..4	Current correction factor for relays	100	0	100	%	M	NO
LOAD CONFIG (Load A to t)							
EOa..EOt	Use nominal current (ENx) to calculate load power consumption (0=measured, 1=nominal)	0	0	1	-	S	NO
ENA..ENt	Nominal load current	0	0	999.9	A	S	NO
READ-ONLY DIAGNOSTICS (VA / kWh)							
EPA..EPt	Load instant power	-	-	-	W	S	NO
ECAa..i	Load cumulative power consumption	-	-	-	kWh	S	NO
EtP	Total instant power to all loads	-	-	-	W	S	NO
ETE	Unit total cumulative energy	-	-	-	kWh	S	NO

Instant power taken from the current sensor readings

To calculate power consumption, the controller's power supply voltage is used as the reference voltage.

Instant power [Watts] = V (controller power supply voltage) × I (current measured by the sensor) × PF (power factor)

The power factor data (PF – default 100%) can be set using parameters EF2, EF3, EF4, associated with relays 2, 3 and 4.

Par.	Description	Def	Min	Max	UOM	User	User terminal
EF2	Current correction factor for relay 2	100	0	100	%	M	NO
EF3	Current correction factor for relay 3	100	0	100	%	M	NO
EF4	Current correction factor for relay 4	100	0	100	%	M	NO

Example: EC fan (high PF) as the load on relay 3.

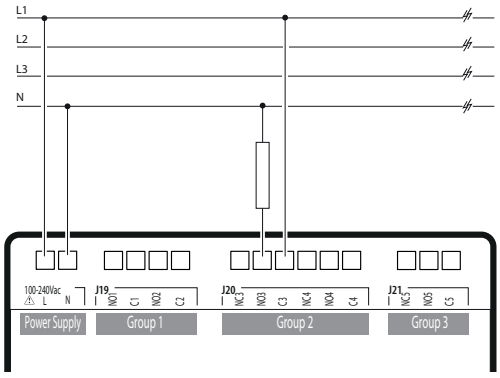


Fig. 6.bb

Controller power supply phase: **L1 (e.g. 230 Vac)**
Load power supply phase: **L2**
Current measured: 0,7 A
Power factor (PF) for relay 3 load: 0.9 → E3c = 90

Instant power [W] = 0.7 A × 230 Vac (L1) × 0.9 = 145 W

Example: AC fan (low PF) as the load on relay 3.

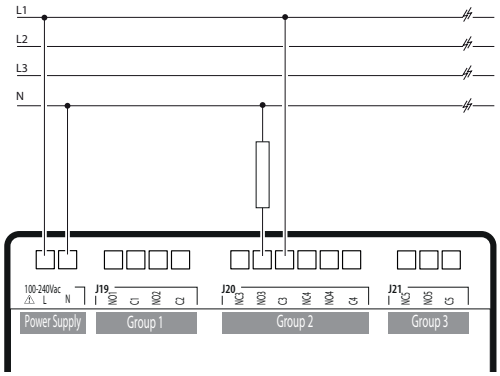


Fig. 6.bc

Controller power supply phase: **L1 (e.g. 230 Vac)**
Load power supply phase: **L2**
Current measured: 1.3 A
PF for relay 3 load: 0.6 → E3c = 60

Instant power [W] = 1.3 A × 230 Vac (L1) × 0.6 = 180 W

Estimated instant power

Power consumption calculation is also available, based on the set nominal power consumption, for relays without a current sensor on the 5-relay and 6-relay models, or for relays with sensors for which the measured data needs to be overwritten.
Parameters nLA..nLi "nominal current" can be used set the estimated current for each load. In these cases, however, any malfunctions cannot be signalled, as the actual current draw cannot be measured.

Parameters ENA...ENt can be set to decide whether the calculation system uses the value measured by the current sensors, or the nominal value set by the parameter (for relays with current sensors). For relays without a current sensor, the "measured value" cannot be selected as it is not available.

Example: AC fan (low PF) as the load on relay 3.

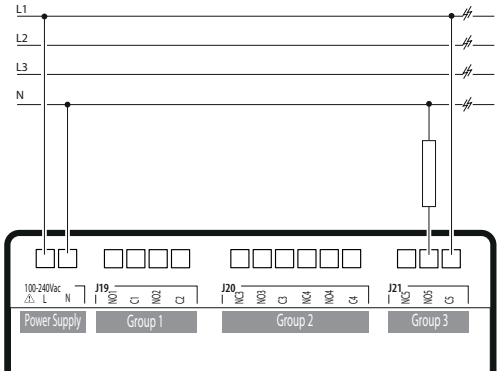


Fig. 6.bd

Relay 5 does not have a current sensor, therefore the current needs to be set.

Controller power supply phase: L1 (e.g. 230 Vac)
Load power supply phase: L3
Nominal current: 0.3 A → nEi = 1, nLi= 300 mA
PF for relay 5 load: 1

Instant power [W] = 0.3 A × 230 Vac (L1) × 1 = 69 W

Notice: in this case, where the current is set manually, the PF will always be 1. The current entered also needs to the correction factor into account, where necessary.

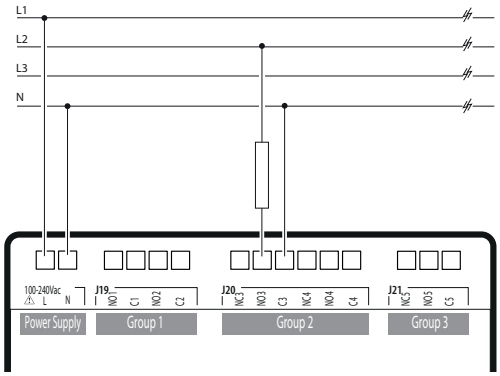


Fig. 6.be

Controller power supply phase: L1 (e.g. 230 Vac)
Load power supply phase: L2
Current measured: 1.3 A
PF for relay 3 load: 0.6 → E3c = 60

Instant power [W] = 1.3 A × 230 Vac (L1) × 0.6 = 180 W

Estimated instant power

Power consumption calculation is also available, based on the set nominal power consumption, for relays without a current sensor on the 5-relay and 6-relay models, or for relays with sensors for which the measured data needs to be overwritten.
Parameters nLA..nLi "nominal current" can be used set the estimated current for each load. In these cases, however, any malfunctions cannot be signalled, as the actual current draw cannot be measured.

Parameters ENA...ENt can be set to decide whether the calculation system uses the value measured by the current sensors, or the nominal value set by the parameter (for relays with current sensors). For relays without a current sensor, the "measured value" cannot be selected as it is not available.

Example: circulating pump as the load on relay 5.

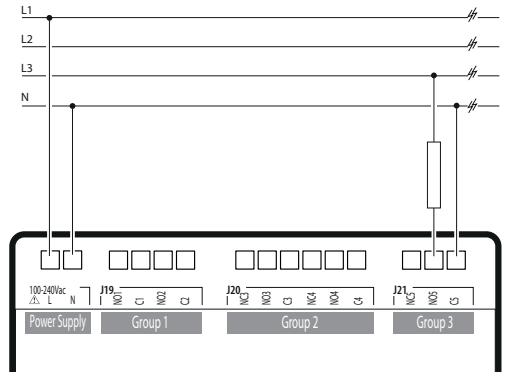


Fig. 6.bf

Relay 5 does not have a current sensor, therefore the current needs to be set.

Controller power supply phase: L1 (e.g. 230 Vac)
Load power supply phase: L3
Nominal current: 0.3 A → nEi = 1, nLi= 300 mA
PF for relay 5 load: 1

Instant power [W] = 0.3 A × 230 Vac (L1) × 1 = 69 W

Notice: in this case, where the current is set manually, the PF will always be 1. The current entered also needs to the correction factor into account, where necessary.

Usage

The calculation system also provides consumption data in kWh, or the integral of the active power over time.
To view power consumption in the APPLICA app, enable periodic logs by setting the controller's RTC and setting at least one of the parameters Log_h or Log_m to a value other than zero.

Par.	Description	Def	Min	Max	UOM	User	User terminal
Log_h	Periodic log sampling - hours 0=disabled	0	0	23	h	S	NO
Log_m	Periodic log sampling - minutes 0=disabled	0	0	59	min	S	NO

Relay failure or excessive current

Parameters Et2 to 4 enable signalling of failed relay activations or excessive current draw on models with 5 digital outputs. Messages LfA to Lfi are displayed on the HMI user terminal in the following cases:

- there is an activation request for a load connected to one of the three relays equipped with current sensor, however for a time set using parameter Adt, the current measured is not higher than the minimum threshold;
- there is no activation request, and the current measured is higher than the minimum threshold.

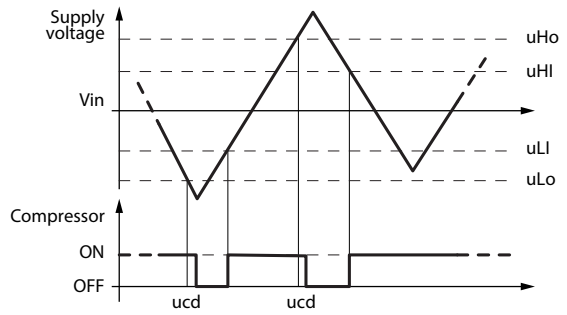
Par.	Description	Def	Min	Max	UOM	User	User terminal
Et2	Relay 2 current sensor alarm delay (0=disabled)	0	0	3600	s	M	NO
Et3	Relay 3 current sensor alarm delay (0=disabled)	0	0	3600	s	M	NO
Et4	Relay 4 current sensor alarm delay (0=disabled)	0	0	3600	s	M	NO

Notice: the readings of the three current sensors can be used as control variables for the generic functions (see ("Generic functions").

6.10 High and Low Voltage Protection (HLVP)

The MPXPRO controller includes high and low supply voltage protection, which allows compressor operation only when the voltage is within the operating limits. This function turns off the compressor if the mains voltage goes outside the range defined by parameters uHo and uLo. The shutdown occurs after a delay set via parameter ucd. The compressor restarts when the voltage returns within the limits set by parameters uHI and uLI.

Par.	Description	Def	Min	Max	UOM	User	User terminal
c1	Delay to enable solenoid/compressor and evaporator fans at power on	0	0	15	min	M	YES
c2	Min time between consecutive compressor starts	0	0	15	min	M	YES
c3	Minimum compressor OFF time	0	0	15	min	M	YES
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 = disabled; 1 = enabled.	0	0	1	-	M	NO
uEn	Enable HLVP protection: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
uHi	High voltage protection start threshold	245	0	350	V	S	NO
uHo	High voltage protection end threshold	255	0	350	V	S	NO
uLi	Low voltage protection start threshold	205	0	350	V	S	NO
uLo	Low voltage protection end threshold	195	0	350	V	S	NO



Ref.	Description
Supply voltage	Power supply voltage
Compressor	Compressor

Fig. 6.bg

Notice: compressor protection timing parameters c1 and c3 are not respected when high or low voltage conditions are detected, while c2 is always respected.

Caution:
- this function must not be considered a safety function for the compressor;
- using the controller outside the nominal operating voltage range specified in the technical specifications is the responsibility of the customer.

6.11 Generic functions

MPXPRO allows the use of unused inputs and outputs to configure generic functions, either via the APPLICA App or the configuration tool.

The following can be activated (maximum configuration):
- 1 generic function with On/Off output;
- 1 generic function with modulating output (Medium or Advanced models 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.

Caution: 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.

Enabling

The generic function can be enabled always, or when the unit is in a certain status, through GFS_E, GFM_E e GFA_E parameters.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_E	Generic stepped function, enable: 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
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

The control probes for the generic function can be selected using parameters GFS_1, GFS_2, GFM_1, GFM_2, GFA_1, and GFA_2. The control variable can be set via parameters GFS_F and GFM_F, allowing selection between the difference between the two probes, the minimum value, the maximum value, or the average.

Notice: for the generic alarm function, if both probes are configured, the control variable is always the difference between the two.

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_1	Generic step function, control probe 1: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = evaporation pressure (PEu); 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = ambient humidity (SU); 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu); 15 = superheat (SH); 16 = valve position (PPU); 17 = evaporator fan request %; 18 = anti-sweat request %; 19 = auxiliary pressure 1 (AuxP); 20 = auxiliary pressure 2 (AuxP2); 21 = current sensor relay 2(*); 22 = current sensor relay 3(*); 23 = current sensor relay 4(*). 24 = intake temperature (Sr2)- (*) only for 5-relay models.	0	0	23	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFS_1	0	0	23	-	S	NO
GFM_1	Generic modulating function, control probe 1 - see GFS_1	0	0	23	-	S	NO
GFM_2	Generic modulating function, control probe 2 - see GFS_1	0	0	23	-	S	NO
GFA_1	Generic alarm function, control probe 1 - see GFS_1	0	0	23	-	S	NO
GFA_2	Generic alarm function, control probe 2 - see GFS_1	0	0	23	-	S	NO
GFS_F	Generic stepped function, control variable: 0 = GFS_1 – GFS_2; 1 = minimum between GFS_1 and GFS_2; 2 = maximum between GFS_1 and GFS_2; 3 = average between GFS_1 and GFS_2.	0	0	3	-	S	NO
GFM_F	Generic modulating function, control variable: 0 = GFM_1 – GFM_2; 1 = minimum between GFM_1 and GFM_2; 2 = maximum between GFM_1 and GFM_2; 3 = average between GFM_1 and GFM_2.	0	0	3	-	S	NO

Notice: auxiliary probes 1 and 2 can be configured as temperature or pressure probes, by setting parameters /P1, /P3, /P4, /P5 and the corresponding limits /UA, /UA2, /LA, /LA2.

6.11.1 On/Off output (step)

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 stepped function, type: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
GFS_S	Generic stepped function, set point	0	-50	200	-	S	NO
GFS_D	Generic stepped function, differential	0	0.0	99.9	-	S	NO
DOS	Assign digital output for generic stepped function - see DOA	0	0	6/7	-	S	NO
DOt	Assign condenser fan digital output - see DOA	0	0	6/7	-	S	NO

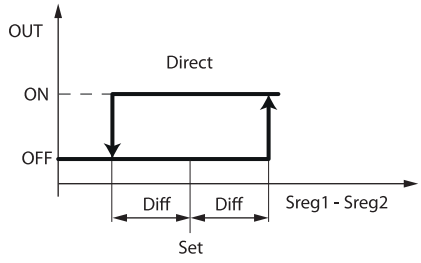


Fig. 6.bh

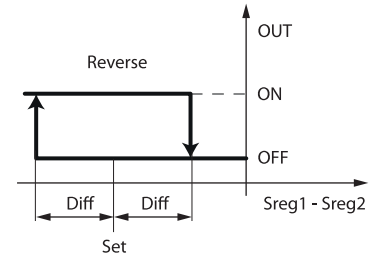


Fig. 6.bi

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

6.11.2 Modulating output

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
/Ad	Assign analogue output for generic modulating function - see /AA	0	0	4	-	S	NO
GFM_CD	Generic modulating function: cut-off differential	0	0	20	-	S	NO
GFM_D	Generic modulating function, differential	0	0	99.9	-	S	NO
GFM_Kp	Generic modulating function, proportional gain	0	0	100	-	S	NO
GFM_H	Generic modulating function, hysteresis	0	0	20	-	S	NO
GFM_Max	Generic modulating function, maximum output value	0	0	100	-	S	NO
GFM_Min	Generic modulating function, minimum output value	0	0	100	-	S	NO
GFM_S	Generic modulating function, set point	0	-50	200	-	S	NO
GFM_T	Generic modulating function, type: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
GFM_Td	Generic modulating function, derivative time	0	0	100	s	S	NO
GFM_Ti	Generic modulating function, integral time	0	0	900	s	S	NO

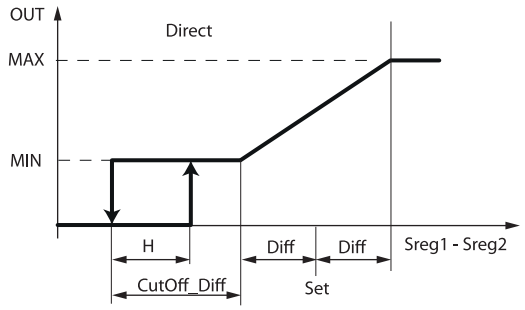


Fig. 6.bj

Ref.	Description
Set	Set point
Diff	Differential
H	Hysteresis
Sreg1 - Sreg2	Control probe 1- Control probe 2
OUT	Digital output
CutOff_Diff	Cut-off differential

6.11.3 Generic alarm

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: check that the alarm is generated by only one of the two causes.

The generic alarm can be configured as either a warning or a serious alarm by setting parameter GFA_AlType, while parameter GFA_AA allows you to define any actions the controller must perform in response to the alarm.

The reset mode for the generic function alarm can be configured as automatic (default), semi-automatic, or manual via parameter GFA_r. In the case of semi-automatic reset, the number of alarm occurrences can be defined using parameter GFA_n, and the corresponding time interval using parameter GFA_P, before requiring a manual reset from the display, supervision system, or APPLICA.

Code	Description	Def	Min	Max	UOM	User	User terminal
DIs	Assign digital input for generic alarm function - see DIA	0	-1	41	-	S	NO
GFA_AA	Generic alarm function, action taken: 0 = no action; 1 = stop control; 2 = reduce capacity; 3 = lights off.	0	0	3	-	S	NO
GFA_AlType	Generic alarm function, type 0 = signal only; 1 = serious alarm.	0	0	1	-	S	NO
GFA_D	Generic alarm function, differential	0	0	99.9	-	S	NO
GFA_Hth	General alarm function, high threshold	0	-50	200	-	S	NO
GFA_Lth	General alarm function, low threshold	0	-50	200	-	S	NO
GFA_n	Generic alarm function, number of attempts before switching from semi-automatic to manual	0	0	99	-	S	NO
GFA_P	Generic alarm function, evaluation period for switching from semi-automatic to manual	0	0	999	min	S	NO
GFA_r	Generic alarm function, reset type 0 = automatic; 1 = semi-automatic; 2 = manual.	0	0	2	-	S	NO

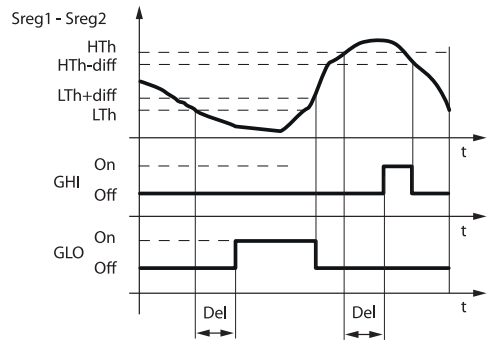


Fig. 6.bk

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. 6.bl

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_WA	Generic alarm function, action taken on warning: 0 = no action; 1 = stop control; 2 = reduce capacity; 3 = lights off.	0	0	3	-	S	NO
GFA_WD	Generic alarm function, warning reset differential	0	0	99.9	-	S	NO
GFA_WDe	Generic alarm function, warning activation delay	0	0	30000	s	S	NO
GFA_We	Generic alarm function, enable warning: 0 = not active; 1 = active.	0	0	1	-	S	NO
GFA_WLth	General alarm function, low warning threshold	0	-50	200	-	S	NO
GFA_WHth	General alarm function, high warning threshold	0	-50	200	-	S	NO

6.12 Manual management of devices

It is possible to switch individual actuators in the unit from automatic to manual mode. This function can be useful for testing actuators during the installation phase.

For digital outputs, the possible states are On or Off, while for analogue outputs, the selection ranges from 0 to 100%. All defaults are set to Auto.

After a time defined by parameter MT, device control automatically returns to automatic mode.

Code	Description	Def	Min	Max	UOM	User	User terminal
CmdAux	Manual AUX output activation command: 0 = Off; 1 = Automatic operation; 2 = On.	1	0	2	-	S	NO
CmdComp	Manual solenoid/compressor output activation command - see CmdAux	1	0	2	-	S	NO
CmdCompAux	Manual auxiliary compressor output activation command - see CmdAux	1	0	2	-	S	NO
CmdFans	Manual fan output activation command - see CmdAux	1	0	2	-	S	NO
DEF	Manual defrost activation command: 0 = deactivated; 1 = activated.	1	0	1	-	S	NO
dFn	Manual network defrost activation command - see DEF	1	0	1	-	S	NO
ManAux	Auxiliary output command	0	0	1	-	S	NO
Lht	Manual light activation command: 0 = off; 1 = on.	1	0	1	-	S	NO
ManCnt	Manual continuous cycle activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManClean	Manual Clean status activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManStb	Manual standby status activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManTmd	Manual Timer function activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
PMP	Enable manual expansion valve positioning: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
PMu	Manual valve position	0	0	100	%	S	NO
MC	Manual compressor position	0	0	100	%	S	NO
MT	Maximum manual/test operation time (0 = no timeout)	60	0	999	min	S	NO

Notice: this selection bypasses control but does not override the alarm thresholds set to safeguard the unit's safety.

6.13 Outputs test

It is possible to activate the digital and analogue outputs of the MPXPRO controller in test mode. This function can be useful for end-of-line testing of individual functions.

The OW_E parameter enables output override. Each function then has a specific enable parameter and an On/Off value for digital outputs or a 0–100% value for analogue outputs, used to force the corresponding output if configured.

After the time set via parameter OW_T, output control returns to normal operation.

Code	Description	Def	Min	Max	UOM	User	User terminal
OW_E	Enable output overwrite for end-of-line testing: 0 = disabled; 1 = enabled.	0	0	1	-	M	NO
OW_T	Time output overwrite enabled for end-of-line testing	0	0	60	min	M	NO
OWA_AA_E	Enable evaporator fan analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_AA_V	Evaporator fan analogue output overwrite value	0	0	100	%	M	NO
OWA_b_E	Enable valve analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_b_V	Valve analogue output overwrite value	0	0	100	%	M	NO
OWA_c_E	Enable gasket heater analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_c_V	Gasket heater analogue output overwrite value	0	0	100	%	M	NO
OWA_d_E	Enable generic analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_d_V	Generic analogue output overwrite value	0	0	100	%	M	NO
OWA_E	Enable solenoid/compressor digital output overwrite - see OW_E	0	0	1	-	M	NO
OWA_E_E	Enable condenser fan analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_E_V	Condenser fan analogue output overwrite value	0	0	100	%	M	NO
OWA_F_E	Enable PWM analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_F_V	PWM analogue output overwrite value	0	0	100	%	M	NO
OWA_G_E	Enable compressor analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_G_V	Compressor analogue output overwrite value	0	0	100	%	M	NO
OWA_VV	Solenoid/compressor digital output overwrite value	0	0	1	-	M	NO
OWAA_E	Enable hot gas defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAA_V	Hot gas defrost digital output overwrite value	0	0	1	-	M	NO
OWAM_E	Enable maximum fan speed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAM_V	Maximum fan speed digital output overwrite value	0	0	1	-	M	NO
OWAN_E	Enable minimum fan speed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAN_V	Minimum fan speed digital output overwrite value	0	0	1	-	M	NO
OWb_E	Enable light digital output overwrite - see OW_E	0	0	1	-	M	NO
OWb_V	Light digital output overwrite value	0	0	1	-	M	NO
OWc_E	Enable AUX digital output overwrite - see OW_E	0	0	1	-	M	NO
OWc_V	AUX digital output overwrite value	0	0	1	-	M	NO
OWd_E	Enable main AUX digital output overwrite - see OW_E	0	0	1	-	M	NO
OWd_V	Main AUX digital output overwrite value	0	0	1	-	M	NO
OWE_E	Enable alarm digital output overwrite - see OW_E	0	0	1	-	M	NO
OWE_V	Alarm digital output overwrite value	0	0	1	-	M	NO
OWF_E	Enable main light digital output overwrite - see OW_E	0	0	1	-	M	NO
OWF_V	Main light digital output overwrite value	0	0	1	-	M	NO
OWG_E	Enable defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWG_V	Defrost digital output overwrite value	0	0	1	-	M	NO
OWH_E	Enable auxiliary evaporator defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWH_V	Auxiliary evaporator defrost digital output overwrite value	0	0	1	-	M	NO
OWI_E	Enable evaporator fan digital output overwrite - see OW_E	0	0	1	-	M	NO
OWI_V	Evaporator fan digital output overwrite value	0	0	1	-	M	NO
OWK_E	Enable auxiliary compressor digital output overwrite - see OW_E	0	0	1	-	M	NO
OWK_V	Auxiliary compressor digital output overwrite value	0	0	1	-	M	NO
OWn_E	Enable liquid valve digital output overwrite - see OW_E	0	0	1	-	M	NO
OWn_V	Liquid valve digital output overwrite value	0	0	1	-	M	NO
OWo_E	Enable timed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWo_V	Timed digital output overwrite value	0	0	1	-	M	NO
OWP_E	Enable condensate drain heater digital output overwrite - see OW_E	0	0	1	-	M	NO
OWP_V	Condensate drain heater digital output overwrite value	0	0	1	-	M	NO
OWQ_E	Enable anti-sweat heater digital output overwrite - see OW_E	0	0	1	-	M	NO
OWQ_V	Anti-sweat heater digital output overwrite value	0	0	1	-	M	NO
OWS_E	Enable generic digital output overwrite - see OW_E	0	0	1	-	M	NO
OWS_V	Generic digital output overwrite value	0	0	1	-	M	NO
OWt_E	Enable condenser fan digital output overwrite - see OW_E	0	0	1	-	M	NO
OWt_V	Condenser fan digital output overwrite value	0	0	1	-	M	NO

⚠ **Caution:** this operating mode bypasses not only control but also all configured safety protections, and must be used exclusively for dry-run output tests carried out by qualified and properly trained personnel.

7. PARAMETERS TABLE

Below is the table of parameters that can be modified from the terminal, using the commissioning tools or the APPLICA app.

There are 3 preconfigured parameter access levels: User (U), Service (S) and Manufacturer (M).
The User level logs in without a password and has limited access to the parameters. The default passwords to access the Service and Manufacturer parameters are 22 and 44 respectively. The higher-level passwords also allow access to the lower level parameters, i.e. the Service level also has access to the User parameters and the Manufacturer level has access to all parameters.

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 and PDS can be used to set new passwords, with a maximum length of 8 characters, both alphanumeric and special.
- the parameter code shown in the apps and in the commissioning tools; on the 7-segment display, some letters may be displayed in upper/lower case, for example "B" -> "b", "T"-> "t", etc.;
- some parameters are visible on the 7-segment display based on the value of other parameters;
- values marked with a (*) may not be displayed correctly on the 7-segment display, as the display limits are -999/999.

7.1 Unit

Code	Description	Def	Min	Max	UOM	User	User terminal
In	Type of unit: 0 = secondary; 1 = main.	0	0	1	-	S	YES
Scn	Number of the secondary with parameters displayed on HMI	0	0	9	-	S	YES
Sn	Number of secondary devices in the local network	0	0	9	-	S	YES
PDM	Manufacturer password	44	0	999	-	M	NO
PDS	Service password	22	0	999	-	S	NO
PDU	User password	-	0	999	-	S	NO
WD	Configuration procedure (wizard): 0= not completed; 1 = completed.	0	0	1	-	S	NO
ON	ON/OFF command 0 = OFF; 1 = ON.	0	0	1	-	S	NO
POM	Unit cooling capacity indication	4000/ 5	0	32000/ 42	W/ Hp	S	YES
ONK	Enable unit On/Off command from user terminal: 0 = disabled; 1 = enabled.	1	0	1	-	S	NO
ONS	Unit On/Off command from supervisor	0	0	1	-	S	NO
ResCnt	Number of restarts of MPXPRO	0	0	65536	-	M	NO
Hty	Refrigerated cabinet hardware type	0	0	1	-	M	NO
rSC	Reset to Carel settings	0	0	1	-	M	NO

7.2 Inputs/outputs

Code	Description	Def	Min	Max	UOM	User	User terminal
Analogue inputs (probes)							
/P1	Type of probe, group 1 (S1, S2, S3, S4, S5): 0 = PT1000; 1 = NTC; 2...4 = reserved; 5 = NTC-HT.	1	0	5	-	S	YES
/P3	Type of probe S6: 1 = NTC; 2 = reserved; 3 = 4-20 mA; 4 = 0-10V; 5 = NTC-HT; 6 = 0.5 V-4.5 V.	6	0	6	-	S	YES
/P4	Type of probe S7 - see /P3	1	0	6	-	S	YES
/P5	Type of probe S8 - see /P3	1	0	6	-	S	YES
/FA	Assign outlet temperature probe (Sm): 0 = function disabled; 1 = S1 probe; 2 = S2 probe; 3 = S3 probe; 4 = S4 probe; 5 = S5 probe; 6 = S6 probe; 7 = S7 probe; 8 = S8 probe; -1 = 11 serial probe; -2 = 12 serial probe; -3 = 13 serial probe; -4 = 14 serial probe.	1	-4	8	-	S	YES
/FAF	Assign auxiliary pressure probe 1 (SPaux) - see /FA	0	-4	8	-	S	NO
/FAG	Assign auxiliary pressure probe 2 (SPaux2) - see /FA	0	-4	8	-	S	NO
/Fb	Assign defrost temperature probe (Sd) - see /FA	2	-4	8	-	S	YES
/Fc	Assign intake temperature probe (Sr) - see /FA	3	-4	8	-	S	YES
/Fc2	Assign intake temperature probe 2 (Sr2)	0	-4	8	-	S	NO
/Fd	Assign superheated gas temperature probe (tGS) - see /FA	4	-4	8	-	S	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
/FE	Assign saturated evaporation pressure/temperature probe (PEu/tEu) - see /FA. For the secondary, if /FE = 0 the value is shared with the main.	6	-4	8	-	S	YES
/FF	Assign defrost temperature probe 2 (Sd2) - see /FA	0	-4	8	-	S	YES
/FG	Assign auxiliary temperature probe 1 (Saux) - see /FA	0	-4	8	-	S	YES
/FH	Assign auxiliary temperature probe 2 (Saux2) - see /FA	0	-4	8	-	S	YES
/FI	Assign ambient temperature probe (SA) - see /FA. For the secondary, if /FI = 0 the value is shared with the main.	0	-4	8	-	S	YES
/FL	Assign ambient humidity probe (SU) - see /FA. For the secondary, if /FL = 0 the value is shared with the main.	0	-4	8	-	S	YES
/FM	Assign glass temperature probe (Svt) - see /FA	0	-4	8	-	S	YES
/Fn	Assign dewpoint value (SdP) - see /FA. For the secondary, if /Fn = 0 the value is shared with the main.	0	-4	0	-	S	YES
/Fo	Assign condenser fan control probe (Sc) - see /FA	0	-4	8	-	S	YES
/cA	Outlet temperature probe (Sm) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cAF	Auxiliary pressure probe 1 (SPaux) calibration	0	-20/ -290	20/ 290	Δ barg/psig	S	YES
/cAG	Auxiliary pressure probe 2 (SPaux2) calibration	0	-20	20	Δ barg/psig	S	YES
/cb	Defrost temperature probe (Sd) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cc	Intake temperature probe (Sr) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cc2	Intake temperature probe 2 (Sr2) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	NO
/cd	Superheated gas temperature probe (tGs) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cE	Saturated evaporation temperature/pressure probe (PEu/tEU) calibration	0	-20/ -290	20/ 290	Δ barg/psig	S	YES
/cF	Defrost temperature probe 2 (Sd2) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cG	Auxiliary temperature probe 1 (Saux1) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cH	Auxiliary temperature probe 2 (Saux2) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cI	Ambient temperature probe (SA) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cL	Ambient humidity probe (SU) calibration	0	-20	20	Δ %rH	S	YES
/cM	Glass temperature probe (Svt) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/cn	Dewpoint value (SdP) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/co	Saturated evaporation temperature (tEu) calibration	0	-20 /-36	20/ 36	Δ °C/°F	S	YES
/UE	Maximum value for saturated evaporation pressure/temperature probe (PEu/tEu)	60/870.2	/LE	200/ 2900.7 (*)	barg/ psig	S	YES
/LE	Minimum value for saturated evaporation pressure/temperature probe (PEu/tEu)	0	-1/ -14.5	/UE	barg/ psig	S	YES
/LA	Minimum value for active auxiliary temperature probe 1 (Saux)	-30/ -22	-50/ -58	/UA	°C/°F	S	YES
/LA2	Minimum value for active auxiliary temperature probe 2 (Saux2)	-30/ -22	-50/ -58	/UA2	°C/°F	S	NO
/UA	Maximum value for active auxiliary temperature probe 1 (Saux)	90/ 194	/LA	200/ 392	°C/°F	S	YES
/UA2	Maximum value for active auxiliary temperature probe 2 (Saux2)	90/ 194	/LA2	200/ 392	°C/°F	S	NO
/LAP	Minimum value for auxiliary pressure probe 1 (SPaux)	0	-1/ -14.5	/UAP	barg/ psig	S	NO
/LAP2	Minimum value for auxiliary pressure probe 2 (SPaux2)	0	-1/ -14.5	/UAP2	barg/ psig	S	NO
/UAP	Maximum value for auxiliary pressure probe 1 (SPaux)	60/ 870.2	/LAP	200/ 2900.7 (*)	barg/ psig	S	NO
/UAP2	Maximum value for auxiliary pressure probe 2 (SPaux2)	60/ 870.2	/LAP2	200/ 2900.7 (*)	barg/ psig	S	NO
/UL	Maximum value for ambient humidity probe (SU)	100	/LL	100	%rH	S	YES
/LL	Minimum value for ambient humidity probe (SU)	10	10	/UL	%rH	S	YES
/2	Analogue probe measurement stability (filter): 1= probe reading not delayed; ... 15= maximum probe reading delay	9	1	15	-	S	YES
/3	Display probe value: 0 = disabled; 1 = fast update; ... 15 = slow update.	0	0	15	-	S	YES

Digital inputs

/P2	Group 1 inputs used as digital inputs: 0 = none; 1 = S4/D; 2 = S4/D and S5/D.	0	0	2	-	S	YES
A9	Selection of digital input propagated from main to secondary (only on main): -1 = from supervisor; 0 = disabled; 1 = digital input 1 (DI1); 2 = digital input 2 (DI2); 3 = digital input 3 (DI3); 4 = digital input 4 (S4/D); 5 = digital input 5 (S5/D).	0	-1	5	-	S	YES
DIA	Assign digital input for immediate external alarm: -1 = serial digital input; 0 = function disabled; 34 = digital input 4 (S4/D); 35 = digital input 5 (S5/D); 39 = digital input 1 (ID1); 40 = digital input 2 (ID2); 41 = digital input 3 (ID3).	0	-1	41	-	S	NO
DIb	Assign delayed external alarm digital input - see DIA	0	-1	41	-	S	NO
DIc	Assign enable defrost digital input - see DIA	0	-1	41	-	S	NO
DId	Assign start defrost digital input - see DIA	0	-1	41	-	S	NO
DIE	Assign digital input for door contact with solenoid/compressor and evaporator fans OFF - see DIA	0	-1	41	-	S	NO
DIF	Assign remote ON/OFF digital input - see DIA	0	-1	41	-	S	NO
DIG	Assign curtain contact digital input - see DIA	0	-1	41	-	S	NO
DIH	Assign start/stop continuous cycle digital input - see DIA	0	-1	41	-	S	NO
DIl	Assign status monitoring digital input - see DIA	0	-1	41	-	S	NO
DIL	Assign timed digital input - see DIA	0	-1	41	-	S	NO
DIM	Assign digital input for switching to standby mode - see DIA	0	-1	41	-	S	NO
DIn	Assign digital input for switching to clean mode - see DIA	0	-1	41	-	S	NO
DIo	Assign working parameter set change digital input - see DIA	0	-1	41	-	S	NO
DIP	Assign door contact without control stop digital input - see DIA	0	-1	41	-	S	NO
DIr	Assign defrost according to DI status digital input - see DIA	0	-1	41	-	S	NO
DIs	Assign digital input for generic alarm function - see DIA	0	-1	41	-	S	NO
DIV	Assign digital input for enabling alternative superheat set point - see DIA	0	-1	41	-	S	NO
DIZ	Assign low pressure switch digital input - see DIA	0	-1	41	-	S	NO
rIA	Immediate alarm digital input logic: 0 = NC; 1 = NO.	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 contact with solenoid/compressor and evaporator fans OFF digital input logic - see rIA	0	0	1	-	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
rIF	Remote ON/OFF digital input logic - see rIA	0	0	1	-	S	NO
rIG	Curtain contact 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
rII	Status monitoring digital input logic - see rIA	0	0	1	-	S	NO
rIL	Timed digital input logic - see rIA	0	0	1	-	S	NO
rIM	Digital input for switching to standby mode logic - see rIA	0	0	1	-	S	NO
rIn	Digital input for switching to clean mode logic - see DIA	0	0	1	-	S	NO
rIo	Digital input for changing parameter set configuration logic - see rIA	0	0	1	-	S	NO
rIP	Digital input for door contact without control stop logic - 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 alarm function digital input logic - see rIA	0	0	1	-	S	NO
rIV	Digital input for enabling alternative superheat set point logic - see rIA	0	0	1	-	S	NO
rIZ	Low pressure switch digital input logic - see rIA	0	0	1	-	S	NO
dIt	Timer duration for timed digital input (0 = function disabled)	0	0	999	min	S	YES
Analogue outputs							
/AA	Assign analogue output for modulating evaporator fans: 0 = not configured; 1 = analogue output 1 (Y1); 2 = analogue output 2 (Y2); 3 = analogue output 3 (Y3); 4 = analogue output 4 (Y4);	0	0	4	-	S	NO
/Ab	Assign analogue output for modulating valve - see /AA	0	0	4	-	S	NO
/Ac	Assign analogue output for modulating anti-sweat heaters - see /AA	0	0	4	-	S	NO
/Ad	Assign analogue output for generic modulating function - see /AA	0	0	4	-	S	NO
/AE	Assign analogue output for modulating condenser fans - see /AA	0	0	4	-	S	NO
/AG	Assign analogue output for modulating compressor - see /AA	0	0	4	-	S	NO
/P6	Type of analogue output 1 (Y1): 0 = 0-10 V; 1 = PWM 100 Hz; 2 = PWM 2 kHz; 3 = frequency modulation.	0	0	3	-	S	YES
/P7	Type of analogue output 2 (Y2) - see /P6	0	0	3	-	S	YES
/P8	Type of analogue output 3 (Y3) - see /P6	0	0	3	-	S	YES
/P9	Type of analogue output 4 (Y4) - see /P6	0	0	3	-	S	YES
Digital outputs							
DOA	Assign solenoid/compressor digital output: 0 = function disabled; 1 = digital output 1 (NO1); 2 = digital output 2 (NO2); 3 = digital output 3 (NO3); 4 = digital output 4 (NO4); 5 = digital output 5 (NO5); 6 = digital output 6 (NO6/SSR); 7 = digital output 7 (SSR), only for models with 6 relays. **Note:** for SSR outputs, check the actual availability in the model used	2	0	6/7	-	S	NO
DOAA	Assign digital output for hot gas defrost - see DOA	0	0	6/7	-	S	NO
DOAM	Assign digital output for maximum fan speed - see DOA	0	0	6/7	-	S	NO
DOAN	Assign digital output for minimum fan speed - see DOA	0	0	6/7	-	S	NO
DOb	Assign alarm digital output - see DOA	5	0	6/7	-	S	NO
DOc	Assign auxiliary digital output - see DOA	0	0	6/7	-	S	NO
DOd	Assign digital output for auxiliary output serving the main on secondary devices - see DOA	0	0	6/7	-	S	NO
DOE	Assign light digital output - see DOA	1	0	6/7	-	S	NO
DOF	Assign light digital output serving the main on secondary devices - see DOA	0	0	6/7	-	S	NO
DOG	Assign defrost digital output - see DOA	3	0	6/7	-	S	NO
DOH	Assign auxiliary evaporator defrost digital output - see DOA	0	0	6/7	-	S	NO
DOHE	Assign hot gas valve equalisation digital output	0	0	6/7	-	S	NO
DOI	Assign evaporator fan digital output - see DOA	4	0	6/7	-	S	NO
DOk	Assign second ON/OFF compressor digital output - see DOA	0	0	6/7	-	S	NO
DOn	Assign digital output for liquid valve - see DOA	0	0	6/7	-	S	NO
DOo	Assign timed digital output - see DOA	0	0	6/7	-	S	NO
DOP	Assign condensate drain pan heater digital output - see DOA	0	0	6/7	-	S	NO
DOQ	Assign anti-sweat heater digital output - see DOA	0	0	6/7	-	S	NO
DOS	Assign digital output for generic stepped function - see DOA	0	0	6/7	-	S	NO
DOt	Assign condenser fan digital output - see DOA	0	0	6/7	-	S	NO
rOA	Solenoid/compressor digital output logic: 0 =NO; 1 = NC.	0	0	1	-	S	NO
rOAA	Hot gas defrost digital output logic - see rOA	0	0	1	-	S	NO
rOAM	Maximum fan speed digital output logic - see rOA	0	0	1	-	S	NO
rOAN	Minimum fan speed digital output logic - see rOA	0	0	1	-	S	NO
rOb	Alarm digital output logic - see rOA	0	0	1	-	S	NO
rOc	Auxiliary output digital output logic - see rOA	0	0	1	-	S	NO
rOd	Digital output logic for aux. output serving the main on secondary devices - see rOA	0	0	1	-	S	NO
rOE	Light digital output logic - see rOA	0	0	1	-	S	NO
rOF	Digital output logic for light serving the main on secondary devices - 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
rOHE	Hot gas equalising valve digital output logic - see rOA	0	0	1	-	S	NO
rOI	Evaporator fan digital output logic - see rOA	0	0	1	-	S	NO
rOK	Second ON/OFF compressor digital output logic - see rOA	0	0	1	-	S	NO
rOn	Liquid valve digital output logic - see rOA	0	0	1	-	S	NO
rOo	Digital output logic associated with timer function - see rOA	0	0	1	-	S	NO
rOP	Condensate drain heater digital output logic - see rOA	0	0	1	-	S	NO
rOQ	Anti-sweat heater digital output logic - see rOA	0	0	1	-	S	NO
rOS	Generic stepped function digital output logic - see rOA	0	0	1	-	S	NO
rOt	Condenser fan digital output logic - see rOA	0	0	1	-	S	NO

Tab. 7.k

7.3 Control

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	YES
r1	Minimum allowed value for the set point	-50/ -58	-50/ -58	r2	°C/°F	M	YES
r2	Maximum allowed value for the set point	50/ 122	r1	200/ 392	°C/°F	M	YES
r4	Automatic night set point variation	0	-50/ -90	50/ 90	Δ °C/°F	M	YES
r6	Probe for night-time control: 0 = virtual probe (Sv); 1 = intake probe (Sr).	0	0	1	-	M	YES
ro	Control offset with probe error	0	0	20/ 36	°C/°F	S	YES
r7	Main solenoid valve configuration: 0 = local valve; 1 = network valve (connected to the main).	0	0	1	-	M	YES
St	Set point	50/ 122	r1	r2	°C/°F	S	YES
St2	Intake probe set point with double thermostat function	50/ 122	r1	r2	°C/°F	M	YES
rd	Differential	2/ 3.6	0.1	99.9/ 179.8	Δ °C/°F	S	YES
rC	Operating mode: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
rd2	Intake probe differential with double thermostat function (0.0 = function disabled)	0	0	99.9/ 179.8	Δ °C/°F	M	YES
rHS	Virtual probe composition for glass temperature probe estimate: 0 = outlet probe (Sm); 100 = intake probe (Sr).	20	0	100	%	S	YES
rHA	Coefficient A for glass temperature probe estimate	2/ 3.6	-20/ -36	20/ 36	Δ °C/°F	S	YES
rHb	Coefficient B for glass temperature probe estimate	22	0	100	-	S	YES
rHo	Anti-sweat heater modulation offset	2/ 3.6	-20/ -36	20/ 36	Δ °C/°F	S	YES
rHd	Anti-sweat heater modulation differential	0	0	20/ 36	Δ °C/°F	S	YES
rHu	Anti-sweat heater manual activation percentage in period 'rHt' (0 = function disabled)	70	0	100	%	S	YES
rHt	Manual anti-sweat heater activation period (0 = function disabled)	5	0	180	min	S	YES
CLM	Output activation during Clean state: 0 = independent lights, fans OFF, control alarms OFF; 1 = lights OFF, fans OFF, control alarms OFF.	0	0	1	-	M	YES
CLt	Max time for clean status	0	0	999	min	M	YES
SBM	Output activation during standby state: 0 = independent lights, fans OFF, control alarms ON; 1 = lights OFF, fans ON, control alarms OFF.	0	0	1	-	M	YES
Stt	Maximum time for standby status	0	0	240	min	M	YES
H14	Time light stays on after closing the door	0	0	240	min	S	YES
db1	Double thermostat function logic: 0 = logical AND; 1 = logical OR.	0	0	1	-	M	NO

Tab. 7.I

7.4 Defrost

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. 5 = hot gas by temperature; 6 = hot gas by time.	0	0	4	-	S	YES
dEP	Select temperature probe to end defrost in advance: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = not available; 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = not available; 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu). 15 = intake temperature 2 (Sr2)	0	0	14	-	S	NO
dEP2	Select temperature probe 2 to end defrost in advance - see dEP1	0	0	15	-	S	NO
dET	Temperature threshold to end defrost in advance	50/ 122	-99.9/ -147.8	99.9/ 211.8	°C/°F	S	NO
dET2	Temperature threshold 2 to end defrost in advance - see dET1	50/ 122	-99.9/ -147.8	99.9/ 211.8	°C/°F	S	NO
d2	End defrost synchronised by main: 0 = not synchronised; 1 = synchronised.	1	0	1	-	S	YES
d3	Send start network defrost command (main): 0 = yes; 1 = no. Ignore start network defrost signal (secondary): 0 = no; 1 = yes.	0	0	1	-	S	YES
dI	Maximum interval between consecutive defrosts	8	0	240	ore	S	YES
dt1	End defrost temperature (read by Sd)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES
dt2	Secondary evaporator end defrost temperature (read by Sd2)	8/ 46.4	-50/ -58	50/ 122	°C/°F	S	YES
dP1	Maximum defrost duration	45	1	240	min	S	YES
dP2	Maximum secondary evaporator defrost duration	45	1	240	min	S	YES
d4	Defrost at power on (main = network defrost; secondary = local defrost): 0 = No; 1 = Yes.	0	0	1	-	S	YES
d5	Defrost delay at power on or (for secondary) after control from main	0	0	240	min	S	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
d6	Display on terminal during defrost: 0 = temperature alternating with 'dEF'; 1 = freeze display; 2 = 'dEF'.	1	0	2	-	S	YES
dd	Dripping time (fans off) after defrost (0 = no dripping)	2	0	15	min	S	YES
d7	Skip defrost: 0 = disabled; 1 = enabled.	0	0	1	-	S	YES
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	YES
d9	Defrost priority over compressor protection times: 0 = compressor protection times observed; 1 = compressor protection times ignored.	1	0	1	-	S	YES
d10	Defrost time in running time mode (0 = function disabled)	0	0	240	min	S	YES
d11	Defrost temperature threshold in running time mode	-30/ -22	-50/ 58	50/ 122	°C/°F	S	YES
d12	Pressure probe alarm management during defrost: 0 = probe error disabled, supervision update enabled; 1 = probe error enabled, supervision update enabled; 2 = probe error disabled, supervision update disabled; 3 = probe error enabled, supervision update disabled.	0	0	3	-	S	YES
dH1	Pump down duration (0 = pump down disabled)	0	0	999	s	S	YES
dHG	Hot gas valve movement duration	0	0	300	s	S	YES
dS1	Compressor off time in sequential stop defrost mode (0 = function disabled)	0	0	45	min	M	YES
dS2	Compressor operating time in sequential stop defrost mode	120	0	240	min	M	YES
ddt	Additional end defrost temperature delta in power defrost mode	0	-20/ -36	20/ 36	Δ °C/°F	S	YES
ddP	Additional maximum defrost time delta in power defrost mode	0	0	60	min	S	YES
dn	Nominal defrost duration for skip defrost	75	0	100	%	S	YES
r3	End defrost signal by timeout: 0 = disabled; 1 = enabled.	0	0	1	-	M	YES
c7	Defrost priority over continuous cycle: 0 = continuous cycle has priority; 1 = defrost has priority.	0	0	1	-	M	YES
dd1	Assign probe 1 to determine start defrost (dd1-dd2) - see dEP	0	0	14	-	S	NO
dd2	Assign probe 2 to determine start defrost (dd1-dd2) - see dEP	0	0	14	-	S	NO
dTd	Temperature differential threshold to start defrost	50/ 122	-99.9/ -147.8	99.9/ 211.8	Δ °C/°F	S	NO
tdd	Threshold evaluation time to start defrost	60	15	240	min	S	NO
dSV	SSV movement duration	0	0	300	s	S	NO
dEH	HGV equalisation time	60	0	900	s	S	NO
dES	SSV equalisation time	60	0	900	s	S	NO
dEO	Overtemperature protection threshold during defrost	50	-50	50	°C/°F	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 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
td1..8-P	Defrost 1 to 8 - enable power defrost: 0 = normal; 1 = power defrost.	0	0	1	-	S	NO
td1..8-time	Defrost 1 to 8 – time (APPLICA app only)	00:00:00	00:00:00	23:59:59	time	S	NO
d1S	Number of daily defrosts (td1): 0 = disabled; 1 = 24 hours 0 minutes; 2 = 12 hours 0 minutes; 3 = 8 hours 0 minutes; 4 = 6 hours 0 minutes; 5 = 4 hours 48 minutes; 6 = 4 hours 0 minutes; 7 = 3 hours 26 minutes; 8 = 3 hours 0 minutes; 9 = 2 hours 40 minutes; 10 = 2 hours 24 minutes; 11 = 2 hours 11 minutes; 12 = 2 hours 0 minutes; 13 = 1 hour 0 minutes; 14 = 30 minutes.	0	0	14	-	S	YES
d2S	Number of daily defrosts (td2) - see d1S	0	0	14	-	S	YES

Tab. 7.m

7.5 Fans

Code	Description	Def	Min	Max	UOM	User	User terminal
Evaporator fans							
F0	Evaporator fan management (Sa = first probe, Sb = second probe, par. FSa, FSb): 0 = always on; 1 = activation based on Sa - Sb (see FSa and FSb); 2 = activation based on Sa; 3 = fans on with door closed (door contact configured, par. DIP).	0	0	3	-	S	YES
F1	Evaporator fan activation threshold (only if F0 = 1 or 2)	-5/ 23	-50/ -58	50/ 122	°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 defrosts: 0 = on; 1 = off.	1	0	1	-	S	YES
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	S	YES
Frd	Fan activation differential (including variable speed)	2/ 3.6	0.1	20/ 36	Δ °C/°F	S	YES
F5	Evaporator fan cut-off temperature (hysteresis 1°C)	50/ 90	F1	50/ 90	Δ °C/°F	S	YES
F6	Maximum evaporator fan speed	100	F7	100	%	S	YES
F7	Minimum evaporator fan speed	0	0	F6	%	S	YES
F8	Evaporator fan start-up time (0 = function disabled)	0	0	240	s	S	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
F10	Evaporator fan time forced at max speed (0 = function disabled)	0	0	240	s	S	YES
FSa	Select first probe for fan control (Sa): 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = evaporation pressure (PEu); 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = ambient humidity (SU); 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu). 15 = intake temperature 2 (Sr2)	2	0	14	-	S	NO
FSb	Select second probe for fan control (Sb) - see FSa	13	0	14	-	S	NO
Fnd	Evaporator fan switch-off time when entering night mode (0 = function disabled)	0	0	240	s	S	NO
Fpd	Evaporator fans during post-dripping 0 = On, 1 = Off	1	0	1	-	S	NO
FSP_A	Modulating evaporator fan speed with external alarm or generic alarm active: -1= function disabled; 0-100 = 0-100%.	-1	-1	100	%	S	NO
FSP_DA	Modulating evaporator fan speed with door alarm - see FSP_A	-1	-1	100	%	S	NO
FSP_DFR	Modulating evaporator fan speed during defrost - see FSP_A	-1	-1	100	%	S	NO
FSP_DIP	Modulating evaporator fan speed with door open - see FSP_A	-1	-1	100	%	S	NO
FSP_EN	Enable evaporator fan modulation: 0 = not enabled; 1 = enabled.	0	0	1	-	S	NO
FSP_F0	Modulating evaporator fan speed based on F0 - see FSP_A	-1	-1	100	%	S	NO
FSP_F2	Modulating evaporator fan speed with compressor (parameter F2) - see FSP_A	-1	-1	100	%	S	NO
FSP_PD	Modulating evaporator fan speed during post-dripping - see FSP_A	-1	-1	100	%	S	NO
Condenser fans							
F00	Condenser fan management: 0 = always on with compressor on 1 = activation based on Sc, off with compressor off.	0	0	1	-	S	NO
F4	Condenser fan deactivation temperature	40/ 104	-50/ -58	200/ 392	°C/°F	S	NO
F5d	Condenser fan activation differential	5/ 9	0.1	60/ 108	Δ °C/°F	S	NO
FCC	Modulating condenser fan cut-off temperature	2/ 35.6	0/ 32	50/ 122	°C/°F	S	NO
FCH	Modulating condenser fan maximum outlet value	100	0	100	%	S	NO
FCL	Modulating condenser fan minimum outlet value	0	0	100	%	S	NO

Tab. 7.n

7.6 Electronic expansion valve (EXV)

Code	Description	Def	Min	Max	UOM	User	User terminal
P1	Electronic valve type: 0 = not used/thermostatic valve; 1 = PWM valve (connected to terminal J14 SSR); 2 = Carel bipolar valve E2V, E3V (connected to terminal J15); 3 = 0-10V modulation for refrigerant flow control 4 = PWM valve modulation for refrigerant flow control 5 = Carel E2V/E3V valve modulation for refrigerant flow control 7 = Carel E4V..E7V valve modulation for refrigerant flow control 8 = 0-10 V modulation	2	0	6	-	M	YES
P3	Superheat set point	10	0	25	K	S	YES
P4	Proportional gain	15	0	100	-	M	YES
P5	Integral time (0 = function disabled)	150	0	900	s	M	YES
P6	Derivative time (0 = function disabled)	5	0	100	s	M	YES
P7	LowSH, low superheat threshold	5	-10	P3	K	S	YES
P8	LowSH, integral time (0 = function disabled)	15	0	240	s	M	YES
P9	LowSH, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES
P10	Enable close solenoid valve for low superheat (LowSH and/or low suction temperature LSA): 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	YES
P11	LSA, low suction temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
P12	LSA, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES
P14	Enable valve alarm at end travel ('blo'): 0 = signal disabled; 1 = signal enabled.	1	0	1	-	M	YES
P15	Support saturated temperature for pressure probe error	-15/ 5	-50/ -58	50/ 122	°C/°F	S	YES
PH	Type of refrigerant used in the unit: 0: Custom; 10: R717; 20: R427A; 30: R170; 40: R454B 1: R22; 11: R744; 21: R245Fa; 31: R442A; 41: R458A 2: R134a; 12: R728; 22: R407F; 32: R447A; 42: R407H 3: R404A; 13: R1270; 23: R32; 33: R448A; 43: R454A 4: R407C; 14: R417A; 24: HTR01; 34: R449A; 44: R454C 5: R410A; 15: R422D; 25: HTR02; 35: R450A; 45: R470A 6: R507A; 16: R413A; 26: R23; 36: R452A; 46: R515B 7: R290; 17: R422A; 27: HFO1234yf; 37: R508B; 47: R466A 8: R600; 18: R423A; 28: HFO1234ze; 38: R452B 9: R600a; 19: R407A; 29: R455A; 39: R513A	11	0	47	-	M	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
PSb	Valve standby position	0	0	100	%	S	YES
PM1	MOP, max saturated evaporation temperature threshold	50/ 122	-50/ -58	50/ 122	°C/°F	S	YES
PM2	MOP, integral time (0 = function disabled)	20	0	800	s	M	YES
PM3	MOP, alarm delay (0 = alarm disabled)	600	0	999	s	M	YES
PM5	MOP, enable solenoid valve closing: 0 = closing disabled; 1 = closing enabled.	0	0	1	-	S	YES
PM6	MOP, maximum threshold of the superheated gas temperature (tGS) for protection enable	30/ 86	-50/ -58	50/ 122	°C/°F	S	YES
PL1	LOP, minimum saturated evaporation temperature threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
PL2	LOP, integral time (0 = function disabled)	0	0	800	s	S	YES
PL3	LOP, alarm delay (0 = alarm disabled)	0	0	240	s	S	YES
cP1	Valve position when control starts	30	0	100	%	S	YES
Pdd	Initial valve position maintenance time after defrost	10	0	30	min	M	YES
Po6	PWM valve modulation period	6	0	20	s	S	YES
Po6H	Threshold % above which the PWM valve output is always ON	95	0	100	%	S	NO
Po6l	Threshold % below which the PWM valve output is always OFF	10	0	100	%	S	NO
dSb	Valve position during defrost: 0 = as defined by the type of defrost; 1 = forced closed; 2 to 100 = opening percentage.	0	0	100	%	S	YES
PSM	Smooth lines, enable function: 0 = disabled; 1 = enabled.	0	0	1	-	M	YES
PLt	Smooth lines, offset to stop control below set point	2/ 3.6	0	10/ 18	Δ °C/°F	M	YES
PHS	Smooth lines, maximum superheat offset	15	0	50	K	M	YES
PSd	Control derivative time (smooth lines or liquid control)	0	0	100	s	M	YES
PSI	Control integral time (smooth lines or liquid control)	150	0	800	s	M	YES
PSP	Smooth lines, proportional gain	5	0	100	-	M	YES
P3A	Very Low Superheat, default superheat set point	5	0	25	K	S	NO
P7d	Very Low Superheat, alternative low superheat alarm threshold	5	-10	P3	K	S	NO
P3d	Very Low Superheat, dynamic superheat set point	0	0	25	K	S	NO
P3E	Very Low Superheat, enable dynamic superheat set point: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
P3n	Very Low Superheat, superheat set point tracking from main (only for secondary)	1	0	2	-	S	NO
P3d	Very Low Superheat, dynamic superheat set point	0	0	25	K	S	NO
P3E	Very Low Superheat, enable dynamic superheat set point: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
P3n	Very Low Superheat, superheat set point tracking from main (only for secondary)	1	0	2	-	S	NO
P3E	Enable dynamic superheat set point: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
TSH	Smooth lines, superheat threshold	0	0	5	K	S	NO
gas_CRC	Custom gas check CRC, reserved parameter	-	-	-	-	-	NO
gas_ c1L... gas_c6L	Custom gas coefficients, reserved parameters	-	-	-	-	-	NO
gas_ c1H... gas_c6L	Custom gas coefficients, reserved parameters	-	-	-	-	-	NO
gas_ID	Custom gas identifier, reserved parameter	-	-	-	-	-	NO

Tab. 7.o

7.7 Solenoid valve/Compressor

Code	Description	Def	Min	Max	UOM	User	User terminal
c0	Delay to enable solenoid/compressor and evaporator fans at power on	0	0	240	min	M	YES
c1	Min time between consecutive compressor starts	0	0	15	min	M	YES
c2	Minimum compressor OFF time	0	0	15	min	M	YES
c3	Minimum compressor ON time	0	0	15	min	M	YES
c4	Solenoid/compressor ON time for duty setting operation: 0 = always OFF; 1-99 = minutes ON (Toff = 15 minutes fixed); 100 = always ON.	0	0	100	min	M	YES
cc	Running time in continuous cycle (0 = function disabled)	0	0	15	ore	M	YES
c11	Second compressor start delay	4	0	250	s	S	NO
C9	Enable solenoid/compressor autostart during pump down: 0 = disabled; 1 = enabled.	0	0	1	-	M	NO
C10	Type of end pump down: 0 = pressure; 1 = time (par. cPt).	0	0	1	-	S	NO
c12	Type of second compressor activation: 0 = by time and temperature; 1 = by time (par. c11).	0	0	1	-	S	NO
cPt	Maximum pump down time (0 = function disabled)	0	0	900	s	S	NO

VCC compressor

cdf	VCC compressor frequency for hot gas defrost	140	0	255	Hz	M	YES
cMA	Maximum VCC compressor rotation frequency	150	0	250	Hz	M	YES
cMf	Maximum VCC compressor control frequency	100	0	255	Hz	M	YES
cMi	VCC compressor switch-off frequency	30	0	250	Hz	M	YES
cnf	Minimum VCC compressor control frequency	52	0	255	Hz	M	YES
cSc	VCC compressor soft start frequency	53	0	255	Hz	M	YES
cSt	VCC compressor soft start time	5	0	240	s	M	NO
ddf	VCC compressor frequency during dripping	140	0	255	Hz	M	NO
cct	VCC compressor off time	1	0	255	min	M	YES
cdt	VCC compressor PID control derivative term	1	0	255	s	M	NO
cPr	VCC compressor PID control proportional term	2	0	800	-	M	NO
ctI	VCC compressor PID control integral term	120	0	999	s	M	NO
cuf	Conversion factor from frequency (Hz) to VCC compressor speed (rpm)	30	0	99.9	-	M	NO

Tab. 7.p

7.8 Alarms

Code	Description	Def	Min	Max	UOM	User	User terminal
A0	High and low temperature alarm reset differential	2/ 3.6	0.1	20/ 36	Δ °C/°F	S	YES
A1	Alarm thresholds relative to the set point St (AL, AH) or absolute (ALA, AHA): 0 = relative; 1 = absolute.	0	0	1	-	S	YES
A2	Alarm thresholds relative to the set point St2 (AL2, AH2) or absolute (ALA2, AHA2): 0 = relative; 1 = absolute.	0	0	1	-	S	YES
A6	Solenoid/compressor control configuration during external alarm (immediate or delayed): 0 = always OFF; 1-99 = minutes ON (Toff = 15 minutes fixed); 100 = always ON.	0	0	100	min	S	YES
A11	Delay time for delayed external alarm (0 = signal-only alarm)	0	0	240	min	S	YES
AA	Assign probe for high (AH/AHA) and low (AL/ALA) temperature alarms: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = not available; 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = not available; 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu). 15 = intake temperature 2 (Sr2)	13	0	14	-	S	YES
AA2	Assign probe for high (AH2, AHA2) and low (AL2, ALA2) temperature alarms - see AA	3	0	14	-	M	YES
AL	Relative low temperature alarm threshold	4/ 7.2	0	50/ 90	Δ °C/°F	S	YES
ALA	Absolute low temperature alarm threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
AH	Relative high temperature alarm threshold	10/ 18	0	50/ 90	Δ °C/°F	S	YES
AHA	Absolute high temperature alarm threshold	50/ 122	-50/ -58	200/ 392	°C/°F	S	YES
AL2	Relative low temperature alarm threshold 2	0	0	50/ 90	Δ °C/°F	S	YES
ALA2	Absolute low temperature alarm threshold 2	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
AH2	Relative high temperature alarm threshold 2	0	0	50/ 90	Δ °C/°F	S	YES
AHA2	Absolute high temperature alarm threshold 2	50/ 122	-50/ -58	200/ 392	°C/°F	S	YES
Ad	Delay time for high and low temperature alarms (AH/AHA, AL/ALA)	120	0	240	min	S	YES
Ad2	Delay time for second high and low temperature alarms (AH2/AHA2, AL2/ALA2)	30	1	240	min	S	YES
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	S	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
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	YES
Ac	Dirty condenser alarm set point	70/ 158	0/ 32	250/ 482	°C/°F	S	NO
Acd	Dirty condenser alarm delay	0	0	240	min	S	NO
AE	Dirty condenser alarm reset differential	5/ 9	0.1	20/ 36	Δ °C/°F	S	NO
rAL	Reset alarm log (caution: irreversible operation)	0	0	1	-	S	NO
res	Reset active alarms	0	0	1	-	S	NO
Adt	Delay time for relay activation failure signalling (0 = signalling disabled)	0	0	999	s	M	NO
MAT	Low temperature alarm (Sm): minimum threshold	-50	-50	50	°C/°F	S	NO
AdM	Low outlet temperature alarm delay	0	0	240	min	S	NO
Maintenance counters							
HMP	Unit operating hour threshold (in thousands)	0	0	45	h*1000	S	NO
HMr	Reset operating hours and maintenance warnings (**Caution**: irreversible operation)	0	0	1	-	S	NO
HMc	Threshold for number of days until next unit maintenance	0	0	3650	days	S	NO
High and low voltage protection (HLVP)							
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 = disabled; 1 = enabled.	0	0	1	-	M	NO
uHi	High voltage protection start threshold	245	0	350	V	S	NO
uHo	High voltage protection end threshold	255	0	350	V	S	NO
uEn	Enable HLVP protection: 0 = disabled; 1 = enabled.	0	0	1	-	S	NO
uLi	Low voltage protection start threshold	205	0	350	V	S	NO
uLo	Low voltage protection end threshold	195	0	350	V	S	NO

Tab. 7.q

7.9 RTC clock

Code	Description	Def	Min	Max	UOM	User	User terminal
y__	Date/time: year	-	17	99	-	S	YES
M_	Date/time: month	-	1	12	-	S	YES
d__	Date/time: day of the month	-	1	31	-	S	YES
h__	Date/time: hour	-	0	23	-	S	YES
m__	Date/time: minute	-	0	59	-	S	YES

Code	Description	Def	Min	Max	UOM	User	User terminal
Day/ night							
tS1..8-d	Start time band 1 to 8 - day: 0 = event disabled; 1 to 7 = Monday to Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = every day.	0	0	11	day	S	NO
tS1..8-time	Start time band 1 to 8 - time (only for App APPLICA) - see (td1...8-d)	00:00:00	00:00:00	23:59:59	time	S	NO
tE1..8-d	End time band 1 to 8 - day - see (td1...8-d)	0	0	11	day	S	NO
tE1..8-time	End time band 1 to 8 - time (only for App APPLICA) - see (td1...8-d)	00:00:00	00:00:00	23:59:59	time	S	NO
rdn	Day/Night status: 0 = night; 1 = day	1	0	1	-	S	NO
H8	Output switched with time bands: 0 = light; 1 = auxiliary output.	0	0	1	-	S	NO
Periodic logs							
Log_h	Start periodic log sampling - hours	0	0	23	ore	S	NO
Log_m	Start periodic log sampling - minutes	0	0	59	min	S	NO

Tab. 7.r

7.10 Connectivity

Code	Description	Def	Min	Max	UOM	User	User terminal
H0	BMS serial or main-secondary local network address	199	1	247	-	S	YES
H1	BMS serial port configuration (stop bits and parity): 0 = 1 stop bit, no parity; 1 = 2 stop bits, no parity; 2 = 1 stop bit, even parity; 3 = 2 stop bits, even parity; 4 = 1 stop bit, odd parity; 5 = 2 stop bits, odd parity.	1	0	5	-	S	YES
H2	BMS serial port baud rate (bit/s): 0 = 1200; 1 = 2400; 2 = 4800; 3 = 9600; 4 = 19200; 5 = 38400; 6 = 57600; 7 = 115200.	4	0	7	-	S	YES
H4	FieldBus 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
H5	Enable NFC memory reading: 0 = disabled; 1 = enabled.	1	0	1	-	S	NO
btc	Timed Bluetooth® communication activation command (par. bto)	0	0	1	-	M	NO
bte	Bluetooth® communication activation mode: 0 = always off; 1 = always activated; 2 = activated by command (parameter btc).	1	0	3	-	M	NO
bto	Bluetooth® communication activation time from command (par. btc).	120	0	999	min	M	NO
H17	BMS 2 serial address	200	1	247	-	S	NO
H18	BMS 2 serial port configuration (stop bits and parity) - see H1	1	0	5	-	S	NO
H19	BMS 2 serial port baud rate (bit/s) - see H2	4	0	7	-	S	NO
BMS2_En	BMS2 serial port enable: 0 = disabled; 1 = enabled.	1	0	1	-	M	NO
SOn	Heart beat function, value written by supervisor	0	0	1	-	S	NO
SOt	Heart beat function, maximum time between two supervisor writes	90	0	9999	s	S	NO
ONS	Unit On/Off command from supervisor	0	0	1	-	S	NO
UsbMode	USB-C port enable: 0 = disabled; 1 = enabled.	1	0	1	-	M	NO

Tab. 7.s

7.11 Display

Code	Description	Def	Min	Max	UOM	User	User terminal
/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	YES
/t	Display signals/alarms on remote display: 0 = disabled; 1 = enabled.	0	0	1	-	S	YES
/t1	Display on user terminal: 0 = terminal disabled; 1...8 = probe 1 to 8; 9 = control probe; 10 = virtual probe (Sv); 11...14 = serial probe 1 to 4; 15 = temp. set point; 16 = superheat.	9	0	16	-	S	YES
/t2	Display on remote display - see /t1	0	0	16	-	S	YES
H6	Enable keypad: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES
Hb	Buzzer: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES
ON	Unit On/Off command from user terminal: 0 = OFF; 1 = ON.	1	0	1	-	S	NO
ONK	Enable unit On/Off command from user terminal: 0 = disabled; 1 = enabled.	1	0	1	-	S	NO

Tab. 7.t

7.12 Power consumption

Code	Description	Def	Min	Max	UOM	User	User term.	Notes
GENERAL PARAMETERS								
ErES	Completely reset progressive consumption data 1 = Reset total kWh	0	0	1	-	M	NO	
Log_h	Periodic log sampling - hours 0=disabled	0	0	23	h	S	NO	Required for Applica
Log_m	Periodic log sampling - minutes 0=disabled	0	0	59	min	S	NO	Required for Applica
PHYSICAL RELAY PARAMETERS (R2, R3, R4)								
EL2..4	Minimum relay current threshold	0	0	100	A	S	NO	Out-of-range alarm
EU2..4	Maximum relay current threshold	0	0	100	A	S	NO	Out-of-range alarm
Et2..4	Current sensor alarm delay (0=disabled)	0	0	3600	s	S	NO	Time filter
EF2..4	Form factor (cos φ) for relays	100	0	100	%	M	NO	Active power estimate
LOAD CONFIG. (Load A to t)								
EOa..EOt	Use nominal current (ENx) to calculate load power consumption (0=measured, 1=nominal)	0	0	1	-	S	NO	
ENA..ENt	Nominal load current	0	0	999.9	A	S	NO	Used if nEx=1
READ-ONLY DIAGNOSTICS (VA / kWh)								
EPA..EPt	Load instant current	-	-	-	VA	S	NO	Live calculated power
ECAa..i	Load cumulative power consumption	-	-	-	kWh	S	NO	Total integrated energy
EtP	Unit total instant current	-	-	-	VA	S	NO	Sum of all loads
ETE	Unit total cumulative energy	-	-	-	kWh	S	NO	Unit total power consumption

Tab. 7.u

7.13 Generic functions

Code	Description	Def	Min	Max	UOM	User	User terminal
GFS_1	Generic step function, control probe 1: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = evaporation pressure (PEu); 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = ambient humidity (SU); 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu); 15 = superheat (SH); 16 = valve position (PPU); 17 = evaporator fan request %; 18 = anti-sweat request %; 19 = auxiliary pressure 1 (AuxP); 20 = auxiliary pressure 2 (AuxP2); 21 = current sensor relay 2 (*); 22 = current sensor relay 3 (*); 23 = current sensor relay 4 (*). 24 = intake temperature 2 (Sr2) (*) only for 5-relay models.	0	0	23	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFS_1	0	0	23	-	S	NO
GFS_E	Generic stepped function, enable: 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_F	Generic stepped function, control variable: 0 = GFS_1 – GFS_2; 1 = minimum between GFS_1 and GFS_2; 2 = maximum between GFS_1 and GFS_2; 3 = average between GFS_1 and GFS_2.	0	0	3	-	S	NO
GFS_T	Generic stepped function, type: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
GFS_S	Generic stepped function, set point	0	-50	200	-	S	NO
GFS_D	Generic stepped function, differential	0	0.0	99.9	-	S	NO
GFM_E	Generic modulating function, enable - see GFS_E	0	0	10	-	S	NO
GFM_1	Generic modulating function, control probe 1 - see GFS_1	0	0	23	-	S	NO
GFM_2	Generic modulating function, control probe 2 - see GFS_1	0	0	23	-	S	NO
GFM_F	Generic modulating function, control variable: 0 = GFM_1 – GFM_2; 1 = minimum between GFM_1 and GFM_2; 2 = maximum between GFM_1 and GFM_2; 3 = average between GFM_1 and GFM_2.	0	0	3	-	S	NO
GFM_T	Generic modulating function, type: 0 = direct; 1 = reverse.	0	0	1	-	S	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
GFM_S	Generic modulating function, set point	0	-50	200	-	S	NO
GFM_D	Generic modulating function, differential	0	0	99.9	-	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	S	NO
GFM_Ti	Generic modulating function, integral time	0	0	900	s	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, maximum output value	0	0	100	-	S	NO
GFM_Min	Generic modulating function, minimum output value	0	0	100	-	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	23	-	S	NO
GFA_2	Generic alarm function, control probe 2 - see GFS_1	0	0	23	-	S	NO
GFA_De	Generic alarm function, delay	0	0	30000	s	S	NO
GFA_ AlType	Generic alarm function, type 0 = signal only; 1 = serious alarm.	0	0	1	-	S	NO
GFA_AA	Generic alarm function, action taken: 0 = no action; 1 = stop control; 2 = reduce capacity; 3 = lights off.	0	0	3	-	S	NO
GFA_n	Generic alarm function, number of attempts before switching from semi-automatic to manual	0	0	99	-	S	NO
GFA_P	Generic alarm function, evaluation period for switching from semi-automatic to manual	0	0	999	min	S	NO
GFA_r	Generic alarm function, reset type: 0 = automatic; 1 = semi-automatic; 2 = manual.	0	0	2	-	S	NO
GFA_D	Generic alarm function, differential	0	0	99.9	-	S	NO
GFA_Hth	General alarm function, high threshold	0	-50	200	-	S	NO
GFA_Lth	General alarm function, low threshold	0	-50	200	-	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 taken on warning: 0 = no action; 1 = stop control; 2 = reduce capacity; 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

Tab. 7.v

7.14 Manual operation

Code	Description	Def	Min	Max	UOM	User	User terminal
CmdAux	Manual AUX output activation command: 0 = Off; 1 = automatic operation; 2 = On.	1	0	2	-	S	NO
CmdComp	Manual solenoid/compressor output activation command - see CmdAux	1	0	2	-	S	NO
CmdCompAux	Manual auxiliary compressor output activation command - see CmdAux	1	0	2	-	S	NO
CmdFans	Manual fan output activation command - see CmdAux	1	0	2	-	S	NO
DEF	Manual defrost activation command: 0 = deactivated; 1 = activated.	1	0	1	-	S	NO
dFn	Manual network defrost activation command - see DEF	1	0	1	-	S	NO
Lht	Manual light activation command: 0 = off; 1 = on.	1	0	1	-	S	NO
ManCnt	Manual continuous cycle activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManClean	Manual Clean status activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManStb	Manual standby status activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
ManTmd	Manual Timer function activation command: 0 = deactivated; 1 = activated.	0	0	1	-	S	NO
PMP	Enable manual expansion valve positioning: 0 = disabled; 1 = enabled.	0	0	1	-	S	SI
PMu	Manual valve position	0	0	100	%	S	SI
MC	Manual compressor position	0	0	100	%	S	NO
MT	Maximum manual/test operation time (0 = no timeout)	60	0	999	min	M	NO
AUX	AUX activation command	0	0	1	-	S	NO
Notice: the following parameters are accessible only via supervisor or commissioning tool.							
OW_E	Enable output overwrite for end-of-line testing: 0 = disabled; 1 = enabled.	0	0	1	-	M	NO
OW_T	Time output overwrite enabled for end-of-line testing	0	0	60	min	M	NO
OWA_AA_E	Enable evaporator fan analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_AA_V	Evaporator fan analogue output overwrite value	0	0	100	%	M	NO
OWA_b_E	Enable valve analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_b_V	Valve analogue output overwrite value	0	0	100	%	M	NO
OWA_c_E	Enable gasket heater analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_c_V	Gasket heater analogue output overwrite value	0	0	100	%	M	NO
OWA_d_E	Enable generic analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_d_V	Generic analogue output overwrite value	0	0	100	%	M	NO
OWA_E	Enable solenoid/compressor digital output overwrite - see OW_E	0	0	1	-	M	NO
OWA_E_E	Enable condenser fan analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_E_V	Condenser fan analogue output overwrite value	0	0	100	%	M	NO
OWA_F_E	Enable PWM analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_F_V	PWM analogue output overwrite value	0	0	100	%	M	NO
OWA_G_E	Enable compressor analogue output overwrite - see OW_E	0	0	1	-	M	NO
OWA_G_V	Compressor analogue output overwrite value	0	0	100	%	M	NO
OWA_VV	Solenoid/compressor digital output overwrite value	0	0	1	-	M	NO
OWAA_E	Enable hot gas defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAA_V	Hot gas defrost digital output overwrite value	0	0	1	-	M	NO
OWAM_E	Enable maximum fan speed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAM_V	Maximum fan speed digital output overwrite value	0	0	1	-	M	NO
OWAN_E	Enable minimum fan speed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWAN_V	Minimum fan speed digital output overwrite value	0	0	1	-	M	NO
OWb_E	Enable light digital output overwrite - see OW_E	0	0	1	-	M	NO
OWb_V	Light digital output overwrite value	0	0	1	-	M	NO

Code	Description	Def	Min	Max	UOM	User	User terminal
OWc_E	Enable AUX digital output overwrite - see OW_E	0	0	1	-	M	NO
OWc_V	AUX digital output overwrite value	0	0	1	-	M	NO
OWd_E	Enable main AUX digital output overwrite - see OW_E	0	0	1	-	M	NO
OWd_V	Main AUX digital output overwrite value	0	0	1	-	M	NO
OWE_E	Enable alarm digital output overwrite - see OW_E	0	0	1	-	M	NO
OWE_V	Alarm digital output overwrite value	0	0	1	-	M	NO
OWF_E	Enable main light digital output overwrite - see OW_E	0	0	1	-	M	NO
OWF_V	Main light digital output overwrite value	0	0	1	-	M	NO
OWG_E	Enable defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWG_V	Defrost digital output overwrite value	0	0	1	-	M	NO
OWH_E	Enable auxiliary evaporator defrost digital output overwrite - see OW_E	0	0	1	-	M	NO
OWH_V	Auxiliary evaporator defrost digital output overwrite value	0	0	1	-	M	NO
OWI_E	Enable evaporator fan digital output overwrite - see OW_E	0	0	1	-	M	NO
OWI_V	Evaporator fan digital output overwrite value	0	0	1	-	M	NO
OWK_E	Enable auxiliary compressor digital output overwrite - see OW_E	0	0	1	-	M	NO
OWK_V	Auxiliary compressor digital output overwrite value	0	0	1	-	M	NO
OWn_E	Enable liquid valve digital output overwrite - see OW_E	0	0	1	-	M	NO
OWn_V	Liquid valve digital output overwrite value	0	0	1	-	M	NO
OWo_E	Enable timed digital output overwrite - see OW_E	0	0	1	-	M	NO
OWo_V	Timed digital output overwrite value	0	0	1	-	M	NO
OWP_E	Enable condensate drain heater digital output overwrite - see OW_E	0	0	1	-	M	NO
OWP_V	Condensate drain heater digital output overwrite value	0	0	1	-	M	NO
OWQ_E	Enable anti-sweat heater digital output overwrite - see OW_E	0	0	1	-	M	NO
OWQ_V	Anti-sweat heater digital output overwrite value	0	0	1	-	M	NO
OWS_E	Enable generic digital output overwrite - see OW_E	0	0	1	-	M	NO
OWS_V	Generic digital output overwrite value	0	0	1	-	M	NO
OWt_E	Enable condenser fan digital output overwrite - see OW_E	0	0	1	-	M	NO
OWt_V	Condenser fan digital output overwrite value	0	0	1	-	M	NO

Tab. 7.w

7.15 Read only parameters

Code	Description	UOM	User	User terminal
aSH	Actual SH set point with applied offsets	K	M	NO
Ast	Actual set point used for control	°C	S	NO
ASt2	Actual set point used for control of double thermostat	°C	S	NO
Aux	Auxiliary temperature probe (Aux)	°C	M	NO
Aux2	Auxiliary temperature probe 2 (Aux2)	°C	M	NO
AuxP	Auxiliary pressure probe (AuxP)	bar	M	NO
AuxP2	Auxiliary pressure probe 2 (AuxP2)	bar	M	NO
bta	Bluetooth enable status	-	S	NO
DEF_Status_s1...s9	Secondary 1 to 9 defrost status	-	S	NO
dFS	Current defrost status: 0 = idle; 1 = calling; 2 = in progress; 3 = check end; 4 = dripping; 5 = post-dripping.	-	S	NO
DT_Day	Day - Current value by internal RTC	day	S	NO
DT_DoW	Day of week - Current value by internal RTC: 0 = Sunday; 1 = Monday ; …; 6 : Saturday.	day	S	NO
DT_Hour	Hour - Current value by internal RTC	ore	S	NO
DT_Min	Minutes - Current value by internal RTC	min	S	NO
DT_Month	Month - Current value by internal RTC	mese	S	NO
DT_Year	Year - Current value by internal RTC	anno	S	NO
ECAa	Anti-sweat heaters progressive consumption	kWh	S	NO
ECAb	Compressor progressive consumption	kWh	S	NO
ECAc	Compressor 2 progressive consumption	kWh	S	NO
ECAd	Defrost progressive consumption	kWh	S	NO
ECAf	Fan progressive consumption	kWh	S	NO
ECAi	Light progressive consumption	kWh	S	NO
ECAt	Total progressive consumption of all loads	kWh	S	NO
EPA	Anti-sweat heater instant power consumption	VA	S	NO
EPb	Compressor instant power consumption	VA	S	NO
EPc	Compressor 2 instant power consumption	VA	S	NO
EPd	Defrost instant power consumption	VA	S	NO
EPf	Fan instant power consumption	VA	S	NO
EPi	Light instant power consumption	VA	S	NO
EPt	Total instant power consumption of all loads	VA	S	NO
EPA	Compressor instant power	W	S	NO
EPC	Auxiliary output instant power	W	S	NO
EPE	Light instant power	W	S	NO
EPG	Defrost instant power	W	S	NO
EPH	Defrost 2 instant power	W	S	NO
EPI	Fan instant power	W	S	NO
EPk	Compressor 2 instant power	W	S	NO
EPP	Condensate drain heater instant power	W	S	NO
EPQ	Anti-sweat heater instant power	W	S	NO
EtP	Total instant power to all loads	W	S	NO
FAA	Evaporator fan analogue output	%	S	NO
FAb	Modulating valve analogue output	%	S	NO
FAc	Anti-sweat heater analogue output	%	S	NO
FAd	Modulating generic function analogue output	%	S	NO
FAE	Condenser fan analogue output	%	S	NO
FAG	Compressor analogue output	%	S	NO
FIA	Immediate external alarm digital input status	-	S	NO

Code	Description	UOM	User	User terminal
FIb	Delayed external alarm digital input status	-	S	NO
FIc	Enable defrost digital input status	-	S	NO
FId	Start defrost digital input status	-	S	NO
FIE	Door contact with solenoid/compressor and evaporator fans OFF digital input status	-	S	NO
FIF	Remote ON/OFF digital input status	-	S	NO
FIG	Curtain contact digital input status	-	S	NO
FIH	Start/stop continuous cycle digital input status	-	S	NO
FII	Monitored digital input status	-	S	NO
FIL	Timed digital input status	-	S	NO
FIM	Switching to standby mode digital input status	-	S	NO
FIn	Switching to clean mode digital input status	-	S	NO
FIo	Parameter set change digital input status	-	S	NO
FIP	Door contact without control stop digital input status	-	S	NO
FIr	Defrost aligned with digital input status	-	S	NO
FIs	Generic alarm digital input status	-	S	NO
FIV	Very low SH enable digital input status	-	S	NO
FIZ	Low pressure switch digital input status	-	S	NO
FOA	Compressor/ solenoid digital output status	-	S	NO
FOA_s1...s9	Secondary 1 to 9 compressor/ solenoid digital output status	-	S	NO
FOAA	Hot gas defrost digital output status	-	S	NO
FOb	Alarm digital output status	-	S	NO
FOc	Auxiliary digital output status	-	S	NO
FOd	Auxiliary serving the main on secondary devices digital output status	-	S	NO
FOE	Light digital output status	-	S	NO
FOF	Light serving the main on secondary devices digital output status	-	S	NO
FOG	Defrost digital output status	-	S	NO
FOH	Auxiliary evaporator defrost digital output status	-	S	NO
FOHE	Hot gas equalising valve output status	-	S	NO
FOI	Evaporator fans digital output status	-	S	NO
FOI_s1...s9	Secondary 1 to 9 evaporator fans digital output status	-	S	NO
FOk	Auxiliary compressor digital output status	-	S	NO
FOn	Liquid valve digital output status	-	S	NO
FOo	Timed digital output status	-	S	NO
FOP	Condensate drain pan heater digital output status	-	S	NO
FOQ	Anti-sweat heater digital output status	-	S	NO
FOs	Generic stepped digital output status	-	S	NO
FOt	Condenser fan digital output status	-	S	NO
HAn	HACCP number of HA type alarms recorded	-	S	NO
HFn	HACCP number of HF type alarms recorded	-	S	NO
HMb	Number of unit operating hours since last reset (in thousands of hours)	ore*1000	S	NO
HMd	Number of days since last maintenance reset	days	S	NO
MyLastOffDate	Last switch off date	date	S	NO
OrAlrm	Alarm present	-	S	NO
P3r	Very low SH - Running status	-	S	NO
PEu	Evaporating pressure probe (PEu)	bar	S	SI
PPU	Valve opening percentage	%	S	SI
PWM_Valve_Request	PWM valve request	%	M	NO
S11...S14	Serial probes 1 to 4 (*)	-	S	NO
SA	Ambient temp. probe (SA)	°C	S	SI
Sc	Condenser temperature probe (Sc)	°C	S	NO
Sd	Defrost temperature probe (Sd)	°C	S	SI
Sd2	Defrost temperature probe 2 (Sd2)	°C	S	NO
Sdp	Dewpoint value (Sdp)	°C	S	NO
SH	Actual superheat reading (SH)	K	S	SI
SL_status	Smooth line status: 0 = deactivated; 1 = activated.	-	S	NO
Sm	Air off temperature probe (Sm)	°C	S	SI
SOcd	Supervisor online countdown	s	S	NO
SOr	Heart beat function, supervisor online: 0 = supervisor offline; 1 = supervisor online.	-	S	NO
Sr	Air on temperature probe (Sr)	°C	S	SI
StS	Unit status: 0 = unit ON; 1 = OFF by alarm; 2 = OFF by supervisor; 3 = OFF by time band; 4 = OFF by digital input; 5 = OFF by keyboard; 6 = Standby; 7 = Clean; 8 = door open; 9 = duty settings; 10 = continuous cycle; 11 = defrost.	-	S	NO
SU	Ambient humidity probe (SU)	%rH	S	SI
Sv	Virtual probe value used for temperature control	°C	S	NO
Svt	Glass temperature probe (Svt)	°C	S	SI
swVers	Current software version	-	M	NO
tEu	Evaporation saturated temperature (tEU)	°C	S	SI
tEvap	Evaporator saturated temperature only for data log purpose	°C	S	NO
tGs	Suction temp. probe (tGs)	°C	S	SI
UID_0...7	UID, byte 0 to 7 (*)	-	M	NO
UnitOn	Unit ON status: 0 = OFF; 1 = ON.	-	S	NO
vdI	Time remaining until next defrost (by dI)	min	S	NO
vSr	Variable speed compressor request	Hz	S	NO
vdS	Time remaining until next defrost (from scheduler)	min	S	NO
vd1	Time remaining until next defrost (from d1S)	min	S	NO
vd2	Time remaining until next defrost (from d2S)	min	S	NO

Tab. 7.x

Notice: (*) parameters accessible only via supervisor or commissioning tool.

8. TECHNICAL SPECIFICATIONS

Physical specifications

Dimensions	See figures in the "Installation" chapter
Case	Flame retardant polycarbonate
Mounting	DIN rail
Ball pressure test temperature	125°C
Ingress protection	**IEC**: IP20 rear; IP40 front
	UL: type 1
Front cleaning	Use a soft non-abrasive cloth, neutral detergents or water

Environmental conditions

Storage conditions	-20T70°C, < 90 % RH non-condensing
Operating conditions	-20T60°C, < 90 % RH non-condensing

Electrical specifications

Rated power supply	100/240 Vac
Operating power supply voltage	90/264 Vac
Input frequency (AC)	50/60 Hz
Minimum voltage	550 mArms
Min power consumption	3 W
Max power consumption	22 W
Clockl	precision: ±20 ppm at 25 °C; ±100 ppm in the temperature range -10T60°C; min. date/time retention after power off: 21 days
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	115-230 V input and relay outputs: 4 kV
Surge immunity category	115-230 V input and relay outputs: III
Control device construction	Device to be incorporated
Terminal block	**L, N, J13, J14, J19, J20, J21, J22, J23, J24,** ⏚: male-female plug-in, pitch 5.08, 17-13 AWG/1-2.5 mm²
	J1, J2, J3, J4, J5, J6, J7, J8, J11, J12, J15, J16, J17: male-female plug-in, pitch 3.81, 26-15 AWG/0.14-1.5 mm²
	J9, J10: JST 26...32 AWG/ 0.03...0.13 mm²

User interface

Buzzer	Not included on the controller, built into the remote HMI
Display	Not included on the controller, built into the remote HMI (1-row 7-segment LED, decimal point and multifunction icons)
Lit brackets	RGB LED status indicator
Button	Multifunction button

Connectivity

NFC	Not included on the controller, built into the remote HMI
Bluetooth® Low Energy	Not included on the controller, built into the remote HMI
BMS serial interface	Modbus over RS485, not opto-isolated
Serial LAN interface	Modbus RS485, not opto-isolated, maximum number of devices connected 9
HMI interface	Modbus over RS485, not opto-isolated
HMI repeater interface	Modbus over RS485, not opto-isolated
Optional BMS 2 serial interface	Modbus over RS485, not opto-isolated

Analogue inputs

S1, S2, S3, S4/D, S5/D: NTC / PT1000/ NTC-HT (not configurable separately). **Notice:** S4/D and S5/D can also be used as digital inputs	**NTC:** resolution 0.1 °C; 10kΩ@25°C; beta 3435; error: ±1°C in the range -50T50°C, ±3°C in the range 50T90°C **NTC-HT:** resolution 0.1 °C; 50kΩ@25°C; beta 3977; error: ±1.5°C in the range -15T115°C, ±4°C in the range 40T-15°C and 115T150°C: **PT1000:** resolution 0.1 °C; 1kΩ @ 0°C, error: ± 1° C in the range -50+120°C
S6, S7, S8: NTC / PT1000 / 0.5…4.5V / 0…10V / NTC-HT / 4…20mA (not configurable separately)	**0.5...4.5V:** error 2% fs, typical 1% **4…20mA:** error 5% fs, typical 1% **0…10V:** error 2% fs, typical 1%

Digital inputs

ID1, ID2, ID3	Voltage-free contact, not optically-isolated, typical closing current 5.5mA, voltage with contact open 12V max contact resistance 50 Ω. Fast digital input 0-2 kHz, error 2% fs (not used)
S4/D, S5/D (configurable by parameter)	Voltage-free contact, not optically-isolated, typical closing current 5.5mA, voltage with contact open 3.3V max contact resistance 50 Ω.

Analogue outputs

Y1, Y2, Y3, Y4	**0….10 V**: 1 kΩ, 10 mA max; **PWM** (DC variable: 0..100%) **100Hz**: max 10 V, 10 mA max; **PWM** (DC variable: 10..100%) **2kHz**: max 10 V, 10 mA max; **VCC frequency** control 0...200 Hz: max 10 V, 10 mA max.

Digital inputs

	Group 1	Group 2	Group 3
5-relay models	NO1, NO2	NO3/NC3, NO4/NC4	NO5/NC5
6-relay models	NO1, NO2, NO3, NO4	NO5/NC5	NO6/NC6

5-relay models	6-relay models
SSR: Maximum current:: 0.5 A	**SSR**: Maximum current: 0.5 A
NO1 (SPST) **IEC60730-1: purely resistive load**: 10 A, 240 Vac, 50.000 cycles; 8 A, 240 Vac, 100.000 cycles; **resistive - inductive load** (i.e. motor load): 8(4) A, 240 Vac, 100.000 cycles. **UL60730-1**: **purely resistive load**: 10 A, 240 Vac, 100.000 cycles; **motor load**: 5FLA, 30LRA, 240 Vac, 100.000 cycles; **pilot duty**: B300, 240 Vac, 30.000 cycles; C300, 240 Vac, 100.000 cycles.	**NO1, NO2, NO3, NO4** (SPST) **IEC60730-10: purely resistive load**: 3 A, 240 Vac, 100.000 cycles; **resistive - inductive load** (i.e. motor load): 3(1) A, 240 Vac, 100.000 cycles. **UL60730-1**: **purely resistive load**: 3 A, 240 Vac, 100.000 cycles; **motor load**: 1.9FLA, 11.4LRA, 240 Vac, 30.000 cycles; **pilot duty**: C300, 240 Vac, 30.000 cycles.
NO2 (SPST) **IEC60730-1: purely resistive load**: 6 A, 240 Vac, 100.000 cycles; **resistive - inductive load** (i.e. motor load): 6(6) A, 240 Vac, 100.000 cycles. **UL60730-1**: **purely resistive load**: 6 A, 240 Vac, 100.000 cycles; **motor load**: 6FLA, 60LRA, 240 Vac, 30.000 cycles; 6FLA, 72LRA, 125 Vac, 30.000 cycles; **pilot duty**: B300, 240 Vac, 30.000 cycles.	
NO3, NC3 (SPDT) **IEC60730-1: purely resistive load**: 10 A, 240 Vac, 100.000 cycles **NO**; 10 A, 240 Vac, 30.000 cycles **NC;** 2 A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load)**; resistive - inductive load** (i.e. motor load): 10(2) A, 240 Vac, 100.000 cycles **NO**; 10(2) A, 240 Vac, 30.000 cycles **NC**; 2(2) A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load) . **UL60730-1**: **purely resistive load**: 10 A, 240 Vac, 100.000 cycles **NO**; 10 A, 240 Vac, 30.000 cycles **NC**; **motor load**: 5FLA, 30LRA, 240 Vac, 30.000 cycles **NO**; **pilot duty**: C300, 240 Vac, 30.000 cycles **NO**.	
NO4, NC4 (SPDT) **IEC60730-10: purely resistive load**: 7 A, 240 Vac, 100.000 cycles **NO**; 7 A, 240 Vac, 30.000 cycles **NC;** 2 A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load)**; resistive - inductive load** (i.e. motor load): 6(3) A, 240 Vac, 100.000 cycles **NO**; 6(3) A, 240 Vac, 30.000 cycles **NC**; 2(2) A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load) . **UL60730-1**: **purely resistive load**: 7 A, 240 Vac, 100.000 cycles **NO**; 7 A, 240 Vac, 30.000 cycles **NC**; **motor load**: 2FLA, 12LRA, 240 Vac, 30.000 cycles **NO**; **pilot duty**: C300, 240 Vac, 30.000 cycles **NO**.	
NO5, NC5 (SPDT) **IEC60730-1: purely resistive load**: 6 A, 240 Vac, 100.000 cycles **NO**; 6 A, 240 Vac, 30.000 cycles **NC;** 2 A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load)**; resistive - inductive load** (i.e. motor load): 6(3) A, 240 Vac, 100.000 cycles **NO**; 6(3) A, 240 Vac, 30.000 cycles **NC**; 2(2) A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load) . **UL60730-1**: **purely resistive load**: 6 A, 240 Vac, 100.000 cycles **NO**; 6 A, 240 Vac, 30.000 cycles **NC**; **motor load**: 2FLA, 12LRA, 240 Vac, 30.000 cycles **NO**; **pilot duty**: C300, 240 Vac, 30.000 cycles **NO**.	**NO5, NC5; NO6, NC6** (SPDT) **IEC60730-1: resistive - inductive load** (i.e. motor load): 2(1) A, 240 Vac, 100.000 cycles; 1(1) A, 240 Vac, 30.000 cycles **CO** (both relay contacts with load) . **UL60730-1**: **purely resistive load**: 2 A, 240 Vac, 100.000 cycles **NO**; 2 A, 240 Vac, 100.000 cycles **NC**; **pilot duty**: C300, 240 Vac, 30.000 cycles **NO**.

Power supply to probes and terminals

5V	5 Vdc ± 2% to power the 0.5 to 4.5V ratiometric probes. Maximum current delivered: 25 mA protected against short-circuits
+V	11-13 V to power the 4-20 mA current probes. Maximum current delivered: 70 mA protected against short-circuits

Cable lengths

Clamp	Description	Lmax
J1, J2, J3, J5, J6, J7, J8	Analogue inputs/outputs, digital inputs, probe power	< 10 m
J13 BMS	BMS serial port 1	For serial connections (LAN and BMS) the use of cables suitable for the RS485 standard is required (shielded twisted pair cable). **Caution:** connect the shield to earth, do not connect to the GND on the controller. Connect a 120 Ω terminating resistor between the Tx/Rx+ and Tx/Rx- terminals on the last controller on the RS485 line. With unshielded cables: • in residential/industrial environments: < 10 m; • in domestic applications: < 2 m.
J12 LAN	LAN serial port from main to secondary (Fieldbus 1)	
J17	Optional serial port	
J9, J10	HMI and HMI repeater	In residential/industrial environments: < 25 m. In domestic applications: < 2 m.
J14	Digital output SSR	In residential and industrial environments: unshielded cables In domestic applications: shielded cable earthed at both ends
J15	Valve	In residential/industrial environments: < 2 m with unshielded cable; < 50 m with shielded cable earthed at both ends. In domestic applications: < 2 m.

Conformity

Electrical safety	LVD directive and UL certification: IEC/EN/UL 60730-1, CSA E60730-1, IEC 60335-1
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 refrigerants	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.

Thermometer accuracy certifications	
EN134B5:2023	**NTC-LT:** range -30T20 °C accuracy ±1 °C **NTC-HP:** range -30T20 °C accuracy ±1 °C **PT1000:** range -30T20 °C accuracy ±1 °C **NTC-HT:** range 50T100 °C accuracy ±1 °C
NSF	**NTC:** range 50T90 °C accuracy ±1 °C **PT1000:** range -30T20 °C accuracy ±1 °C

Tab. 8.y

8.1 Connector/cable table

Ref.	Description	Wiring terminals	Wire size (mm²/AWG)
115-230Vac	Controller power supply	Male-female plug-in, 2 pins, pitch 5.08	1...2.5/17...13
J1	Inputs S1, S2	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J2	Inputs S3, S4/D	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J3	Inputs S5/D, S6	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J4	Power supply to +5 V and +V probes	Male-female plug-in, 4 pins, pitch 3.81	0.14...1.5/ 26...15
J5	Inputs S7, S8	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J6	Inputs DI1, DI2, DI3	Male-female plug-in, 5 pins, pitch 3.81	0.14...1.5/ 26...15
J7	Outputs Y1, Y2	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J8	Outputs Y3, Y4	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J9	HMI terminal	JST	0.03...0.13/ 26...32
J10	HMI repeater terminal	JST	0.03...0.13/ 26...32
J11	Not used	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J12	LAN serial	Male-female plug-in, 3 pins, pitch 3.81	0.14...1.5/ 26...15
J13	BMS serial	Male-female plug-in, 3 pins, pitch 5.08	1...2.5/17...13
J14	SSR	Male-female plug-in, 3 pins, pitch 5.08	1...2.5/17...13
⏚	Earth	Plug-in screw terminal, 2-pin, pitch 5.08	1...2.5/17...13
J15	EXV bipolar valve	Connection cable:	0.14...1.5/ 26...15
J17	BMS2 serial	Male-female plug-in, 4 pins, pitch 5.08	1...2.5/17...13
J19	Outputs NO1, NO2	Male-female plug-in, 4 pins, pitch 5.08	1...2.5/17...13
J20	Outputs NC3, NO3, NC4, NO4	Male-female plug-in, 6 pins, pitch 5.08	1...2.5/17...13
J21	Outputs NC5, NO5	Male-female plug-in, 3 pins, pitch 5.08	1...2.5/17...13
J22	Outputs NO1, NO2, NO3, NO4	Male-female plug-in, 6 pins, pitch 5.08	1...2.5/17...13
J23	Outputs NC5, NO5	Male-female plug-in, 3 pins, pitch 5.08	1...2.5/17...13
J24	Outputs NC6, NO6	Male-female plug-in, 3 pins, pitch 5.08	1...2.5/17...13

Tab. 8.z

9. SIGNALS AND ALARMS

9.1 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.

The controller operating status signals are shown in the table.

Display code	Description
CLn	Clean status
dEF	Defrost running
OFF	Switch OFF
Stb	Standby status

Tab. 9.a

Caution: in the event of a permanent "Err" message on the display, contact service (possible display communication error). The display and/or controller may need to be replaced.

9.2 Alarms

9.2.1 Types of alarms

The controller manages three types of alarms, depending on the reset mode:
- **A - automatic:** the alarm is reset and the device restarts automatically when the alarm condition is no longer present;
- **R - semi-automatic:** if the alarm occurs several times, reset becomes manual and an operator needs to physically restart the device;
- **M - manual:** an operator needs to physically restart the device.

For some alarms with semi-automatic reset, the number of activations and/or the evaluation time before switching from automatic to manual can be set, using the corresponding parameters. See Tab. 9.b for details.

Alarms can also be distinguished according to priority:
- **Warning:** signal only, without buzzer activation and without relay activation;
- **Alarm:** signal, buzzer and relay activated.

9.2.2 Alarm signals

Alarms are signalled by the buzzer, if enabled via parameter Hb, and by the flashing ALARM button. The alarm code is shown on the display, alternating with the main value. Alarm activation is recorded in the alarm log. If the alarm is reset automatically, the ALARM button goes off, the alarm code is cleared from the list and the alarm reset event is recorded in the alarm log.
The figure shows the display with an active "HI" alarm.

Fig. 9.a

If more than one error occurs, these are displayed in sequence. A maximum of 10 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). Alarms are also signalled via the alarm digital output, if appropriately configured by setting parameter DoB.

Code	Description	Def	Min	Max	UOM	User	User terminal
Hb	Buzzer: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES

Notice: alarm notifications are disabled while the configuration wizard is running.

Procedure (alarm acknowledgement):
1. press ALARM (PRG for type B display): the buzzer is muted, the alarm code is shown on the display;
2. press UP/DOWN to scroll through the list of alarms;
3. when finished, press ESC and then PRG to exit.

Code	Description	Def	Min	Max	UOM	User	User terminal
res	Reset alarms	0	0	1	-	S	NO

An alarm can be reset by pressing ALARM for more than 3 s, by setting parameter res from the configuration tool, or using the APPLICA app via smartphone (Bluetooth® connection only), via the specific command on the alarms page ("Service" or "Manufacturer" level access required). If the condition that generated the alarm is still present, the alarm will be reactivated after resetting.

9.2.3 Display alarm log

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

Procedure:
1. press PRG until displaying: "PSD";
2. enter the password for the profile;
3. press UP/DOWN until reaching the ALM category; confirm by pressing PRG;
4. 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;
5. select an alarm by pressing PRG and display the code, date, time, minutes and duration (if reset);
6. press ESC one or more times to return to the standard display.

Example:
'HI' -> 'y24' -> 'm06' -> 'd27' -> 'h17' -> 'm23' -> '65'
indicates that 'HI' (high temperature alarm) occurred on 27/06/2024 at 17:23 and lasted 65 minutes.

Code	Description	Def	Min	Max	UOM	User	User terminal
rAL	Reset alarm log **(Caution: irreversible operation)**	0	0	1	-	S	NO

The alarm log can also be deleted by setting parameter rAL, from the configuration tool or the APPLICA app via smartphone, with BLE connection, via the specific command on the alarms page ("Service" level access is required).

Notice: deleting the alarm log is irreversible.

9.2.4 Alarm table

Display code	Description	Display icon flashing	Alarm relay	Buzzer	Reset	Compressor	Defrost	Evaporator fans	Continuous cycle	Comm. to LAN	Solenoid valve shared on network
AtS	Autostart warning during pump down	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
bLo	Valve blocked (P14 = 0 alarm disabled)	⚠	ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
CfA	Analog output configuration error	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
CfD	Digital input configuration error	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
CFO	Digital output configuration error	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
CfL	Warning error setting consumption parameters	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
CHt	High condensing temperature alarm	⚠	ON	ON	manual	Off	unchanged	unchanged	unchanged	YES	NO
CUt	High condensing temperature warning	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
dA	Delayed alarm from external contact	⚠	ON	ON	automatic	duty setting, par. A6, A11	par. A11	par. F2, F0	par. A11	YES	NO
dE3	Valve motor error	⚠	ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
dE5	Warning emergency valve closure	⚠	ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
dEA	Defrost ended early warning	⚠	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
dor	Door open for too long	⚠	ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E1	Probe S1 fault	🔧	OFF	OFF	automatic	unchanged	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
E4	Probe S4 fault	🔧	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E5	Probe S5 fault	🔧	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E6	Probe S6 fault	🔧	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E7	Probe S7 fault	🔧	OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO

Display code	Description	Display icon flashing	Alarm relay	Buzzer	Reset	Compressor	Defrost	Evaporator fans	Continuous cycle	Comm. to LAN	Solenoid valve shared on network
E8	Probe S8 fault		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E11	Serial probe S11 not updated		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E12	Serial probe S12 not updated		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E13	Serial probe S13 not updated		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
E14	Serial probe S14 not updated		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Ed1	Excessive time for defrost 1		OFF	OFF	automatic (120 s after)	unchanged	unchanged	unchanged	unchanged	YES	NO
Ed2	Excessive time for defrost 2		OFF	OFF	automatic (120 s after)	unchanged	unchanged	unchanged	unchanged	YES	NO
EHI	High power supply voltage		ON	ON	automatic	Off	unchanged	unchanged	unchanged	YES	NO
ELO	Low power supply voltage		ON	ON	automatic	Off	unchanged	unchanged	unchanged	YES	NO
Etc	Real time clock not updated		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
GHI	Generic function: MAX threshold exceeded alarm		ON	ON	Par. GFA_r	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	YES	NO
GLO	Generic function: MIN threshold exceeded alarm		ON	ON	Par. GFA_r	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	YES	NO
GPE	Error in the custom gas parameters		ON	ON	automatic	OFF	not performed	OFF	not performed	YES	NO
HA	HACCP type HA		ON	ON	manual	unchanged	unchanged	unchanged	unchanged	YES	NO
HF	HACCP type HF		ON	ON	manual	unchanged	unchanged	unchanged	unchanged	YES	NO
HI	High temperature		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
HI2	High temperature 2		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
IA	Immediate alarm from external contact		ON	ON	automatic	duty setting, par. A6	par. AdE	par. F2, F0	par. AdE	YES	NO
LfA	Anti-condensation heater activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Lfb	Compressor activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Lfc	Compressor 2 activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Lfd	Defrost activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Lff	Fan activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
Lfl	Light activation warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
LO	Low temperature		ON	ON	automatic	Off	unchanged	unchanged	unchanged	YES	NO
LO2	Low temperature 2		ON	ON	automatic	Off	unchanged	unchanged	unchanged	YES	NO
LOP	Low evaporation temperature		ON	ON	automatic (120 s after)	unchanged	unchanged	unchanged	unchanged	YES	NO
LP	Low suction temperature		ON	ON	semi-automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
LSH	Low superheat		ON	ON	automatic (120 s after)	Par. P10	unchanged	unchanged	unchanged	YES	SI
LSA	Low suction temperature		ON	ON	automatic (120 s after)	Par. P10	unchanged	unchanged	unchanged	YES	SI
MA	Communication error with main (only on secondary)		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
MOP	Maximum evaporation pressure		ON	ON	automatic (120 s after)	Par. PM5	unchanged	unchanged	unchanged	YES	SI
Mss	No suction probe warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
n1...n9	Alarm on unit 1 to 9 in the network		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
nFc	Too frequent writing to NFC memory warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
PD	Pump down duration alarm		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
rE	Control probe		ON	ON	automatic	duty setting, par. c4	unchanged	unchanged	unchanged	YES	NO
rEt	Too frequent writing to memory warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
SrC	Maintenance required warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO
u1...u9	Communication error with secondary (only on main)		ON	ON	automatic	unchanged	unchanged	unchanged	unchanged	NO	NO
uGH	Generic function: MAX threshold exceeded warning		OFF	OFF	automatic	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	YES	NO
uGL	Generic function: MIN threshold exceeded warning		OFF	OFF	automatic	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	Par. GFA_AA	YES	NO
WDo	Open door warning		OFF	OFF	automatic	unchanged	unchanged	unchanged	unchanged	YES	NO

Tab. 9.b

9.3 Description of the main alarms and alarm parameters

9.3.1 Temperature alarms

The MPX controller manages two low temperature alarms (LO, LO2) and two high temperature alarms (HI, HI2) with relative or absolute activation thresholds, depending on the value of parameter A1:

- A1 = 0: relative thresholds AL, AL2 and AH, AH2 are used; these indicate the deviation from the set points. If the set points change, the alarm activation thresholds are adjusted automatically.
- A1 = 1, the absolute thresholds ALA, ALA2 and AHA, AHA2 are used; these represent the absolute low temperature and high temperature alarm thresholds, respectively. If the set points change, the activation point remains the same.

The probes to be monitored to signal the alarms can be chosen independently for each pair of alarms LO, HI and LO2, HI2 by setting parameters AA and AA2.

Temperature alarms are disabled:

- during the configuration wizard;
- during the clean procedure;
- during standby status (par. SBM);
- if there is an error on the selected probe;
- for the time set for parameter c6 after running a continuous cycle (low temperature);
- for the time set for parameter d8 after a defrost (high temperature);
- for the time set for parameter Add after opening the door (high temperature).

Parameters Ad, Ad2 set the activation delays, while A0 sets the temperature alarm reset differential.

Notice:

- parameters A0, A1 are common to all temperature alarms.
- The times c6, d8 and Add are summed to Ad, Ad2; for example, after the time Add has elapsed, the delay Ad starts counting before signalling the alarm.

Par.	Description	Def	Min	Max	UOM	User	User terminal
A0	High and low temperature alarm reset differential	2/ 3.6	0.1	20/ 36	Δ °C/°F	S	YES
A1	Alarm thresholds relative to the set point St (AL, AH) or absolute (ALA, AHA): 0 = relative; 1 = absolute.	0	0	1	-	S	YES
AA	Assign probe for high (AH/AHA) and low (AL/ALA) temperature alarms: 0 = not configured; 1 = outlet temperature (Sm); 2 = defrost temperature (Sd); 3 = intake temperature (Sr); 4 = superheated gas temperature (tGS); 5 = not available; 6 = auxiliary defrost temperature (Sd2); 7 = auxiliary temperature 1 (Saux1); 8 = auxiliary temperature 2 (Saux2); 9 = ambient temperature (SA); 10 = not available; 11 = glass temperature (Svt); 12 = dew point (SdP); 13 = virtual probe (Sv); 14 = saturated evaporation temperature (tEu); 15 = intake temperature (Sr)	13	0	14	-	S	YES
AA2	Assign probe for high (AH2, AHA2) and low (AL2, ALA2) temperature alarms - see AA	3	0	14	-	M	YES
Ad	Delay time for high and low temperature alarms (AH/AHA, AL/ALA)	120	0	240	min	S	YES
Ad2	Delay time for second high and low temperature alarms (AH2/AHA2, AL2/ALA2)	30	1	240	min	S	YES
Add	High temperature alarm bypass time for door open	30	1	240	min	S	NO
AH	Relative high temperature alarm threshold	10/ 18	0	50/ 90	Δ °C/°F	S	YES
AHA	Absolute high temperature alarm threshold	50/ 122	-50/ -58	200/ 392	°C/°F	S	YES
AL	Relative low temperature alarm threshold	4/ 7.2	0	50/ 90	Δ °C/°F	S	YES
ALA	Absolute low temperature alarm threshold	-50/ -58	-50/ -58	50/ 122	°C/°F	S	YES
c6	Low temperature alarm bypass time after continuous cycle	60	0	240	min	M	YES
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	YES

Tab. 9.c

Probe assignments (parameters AA, AA2)

Parameter AA selects the probe used to measure the low and high temperature alarms LO and HI with reference to the thresholds AL/ALA and AH/AHA; similarly, parameter AA2 sets the probe used for thresholds AL2/ALA2 and AH2/AHA2.

Relative thresholds (parameters AL, AL2)

Parameters AL, AL2 set the relative activation thresholds for the low temperature alarms LO, LO2. The values measured by the probes set using parameters AA, AA2 are continuously compared against the values of St-AL, St2-AL2, and if the former fall below the latter for a time longer than Ad, Ad2, the low temperature alarms LO, LO2 are activated. Alarms LO, LO2 are automatically reset when the values rise above St-AL+A0, St2-AL2+A0.

Similarly, parameters AH, AH2 set the relative activation thresholds for the high temperature alarms HI, HI2. The values measured by the probes set using parameters AA, AA2 are continuously compared against the values of St-AH, St2-AH2, and if the former rise above the latter for a time longer than Ad, Ad2, the high temperature alarms HI, HI2 are activated.

Alarms HI, HI2 are automatically reset when the values measured fall below St+AH-A0, St2+AH2-A0.

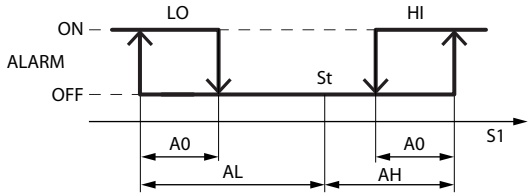


Fig. 9.b

Ref.	Description
LO	Low temperature alarm
HI	High temperature alarm
S1	Probe
St	Set point
AL	Relative low temperature alarm threshold
AH	Relative high temperature alarm threshold
A0	Return differential

Absolute thresholds (parameters ALA, ALA2)

Parameters ALA, ALA2 set the absolute activation thresholds for the low temperature alarms LO, LO2. The values measured by the probes set using parameters AA, AA2 are continuously compared against the values of ALA, AL2, and if the former fall below the latter for a time longer than Ad, the low temperature alarms LO, LO2 are activated. Alarms LO, LO2 are automatically reset when the values rise above ALA+A0, AL2+A0.

Similarly, parameters AHA, AHA2 set the absolute activation thresholds for the high temperature alarms HI, HI2. The values measured by the probes set using parameters AA, AA2 are continuously compared against the values of AHA, AH2, and if the former rise above the latter for a time longer than Ad, the high temperature alarms HI, HI2 are activated.
Alarms HI, HI2 are automatically reset when the values measured fall below AHA-A0, AHA2-A0.

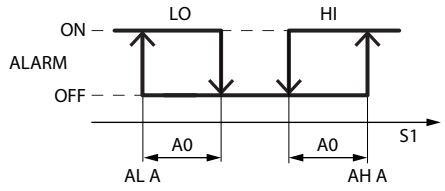


Fig. 9.c

Ref.	Description
LO	Low temperature alarm
HI	High temperature alarm
S1	Probe
AL	Low temperature alarm threshold
AH	High temperature alarm threshold
A0	Return differential

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

9.3.2 HACCP alarms (HACCP = Hazard Analysis and Critical Control Point)

These are 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.).

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.

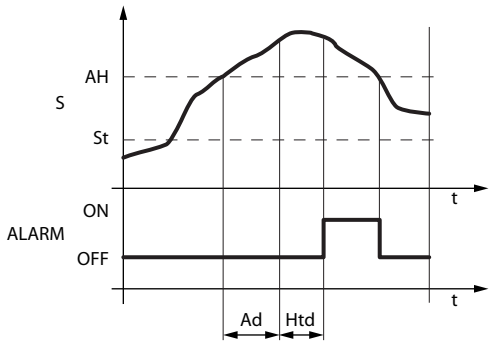
When an alarm occurs, the HACCP icon flashes, the display shows the alarm code, the alarm is logged and the alarm relay and buzzer are activated.

Type HA alarms (parameter Htd)

The type HA alarm is generated if during normal operation the temperature read by the control probe exceeds the high temperature threshold for the time Ad+Htd. Consequently, compared to the normal high temperature alarm already signalled by the controller, the type HA HACCP alarm is delayed by a further time Htd specifically for HACCP recording.

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

Notice: if parameter Htd is set to zero, HACCP high operating temperature alarm monitoring is disabled.



Ref.	Description
S	Control probe
ALARM	Type HA HACCP alarm
t	Time

Fig. 9.d

Read-only parameters HAn, HA1, HA2, HA3 can be used to see the number of HA alarms that have occurred and the date/time the last three alarms were recorded (the previous alarms are available in the alarm log).

Code	Description	UOM	User	User terminal
HAn	Number of type HA alarms (read-only)	-	S	NO
HA1, HA2, HA3 (*)	Activation date and time of the first, second and third type HA alarm (read-only)	-	S	NO

Type HF alarms (parameter Htd)

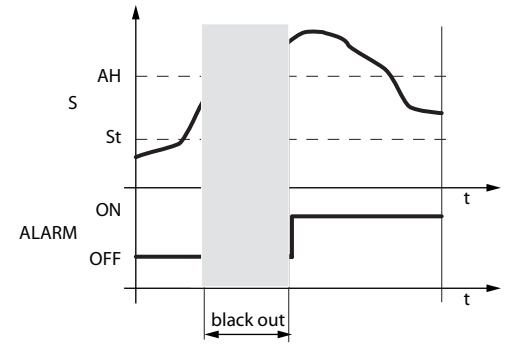
The type HF HACCP alarm is generated following a power failure, if when power returns the temperature read by the control probe exceeds the AH high temperature threshold.

Par.	Description	Def	Min	Max	UOM	User	User terminal
Htd	HACCP alarm delay 80 = monitoring disabled)	0	0	240	min	S	NO

Notice: if parameter Htd is set to zero, HACCP high temperature after power failure alarm monitoring is disabled.

Read-only parameters HFn, HF1, HF2, HF3 can be used to see the number of HF alarms that have occurred and the date/time the last three alarms were recorded (the previous alarms are available in the alarm log).

Par.	Description	UOM	User	User terminal
HFn	Number of type HF alarms (read-only)	-	S	NO
HF1, HF2, HF3 (*)	Activation date and time of the first, second and third type HF alarm (read-only)	-	S	NO



Ref.	Description
S	Control probe
ALARM	Type HF HACCP alarm
t	Time

Fig. 9.e

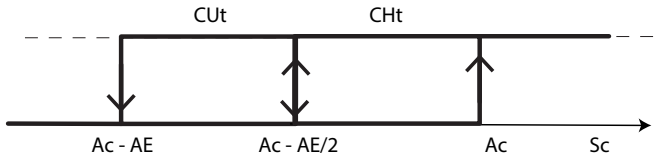
(*) Parameters visible in APPLICA.

The HA and HF alarm signals can be reset by pressing and holding ALARM for more than 3 s.

9.3.3 Dirty condenser alarm

If the condensing temperature probe is connected, the MPX controller can monitor the reading to signal a dirty condenser warning and subsequently, if the abnormal conditions are not resolved, a dirty condenser alarm.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
/Fo	Assign condensing temperature probe (Sc): 0 = function disabled; 1 = probe S1; 2 = probe S2; 3 = probe S3; 4 = probe S4; 5 = probe S5; 6 = probe S6; 7 = probe S7; 8 = probe S8; -1 = serial probe 11; -2 = serial probe 12; -3 = serial probe 13; -4 = serial probe 14.	1	-4	8	-	S	SI
Ac	Dirty condenser alarm set point	70/ 158	0/ 32	250/ 482	°C/°F	S	NO
Acd	Dirty condenser alarm delay	0	0	240	min	S	NO
AE	Dirty condenser alarm reset differential	5/ 9	0.1	20/ 36	Δ °C/°F	S	NO



Ref.	Description
Sc	Condensing temperature probe reading
Ac	Dirty condenser alarm threshold
AE	Dirty condenser alarm differential
CUt	Dirty condenser warning
CHt	Dirty condenser alarm

Fig. 9.f

When the temperature Ac-AE/2 is exceeded, warning "CUt" is generated to signal that the condenser is possibly obstructed. If the temperature subsequently returns below Ac-AE, the warning ceases automatically. If, however, the condensing temperature rises above the alarm threshold Ac for a time longer than the value set using parameter Acd, a dirty condenser alarm "CHt" is generated and the solenoid/compressor output is deactivated. Alarm CHt is reset manually.

9.3.4 Alarms from external contact

The MPX controller manages two external contact alarms, immediate IA and delayed dA.

Immediate external alarm (par. A6)

When the digital input is activated:

- the message 'IA' is shown on the display and the ALARM button starts flashing;
- the buzzer sounds (see par. Hb);
- the alarm relay is activated (see par. DOb);
- the solenoid/compressor output is activated in duty setting mode, as set by parameter A6 (see par. DOA): the solenoid/compressor output remains active for a time equal to the value assigned to A6 and is off for a fixed time of 15 minutes. If A6 = 0, the solenoid/compressor output is always off, while if A6 = 100 it is always on.

Notice: activation of the external alarm shuts down the evaporator fan only if this follows the status of the compressor output, as set for parameter /F2.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
A6	Solenoid/compressor control configuration during external alarm (immediate or delayed): 0 = always OFF; 1-99 = minutes ON (Toff = 15 minutes fixed); 100 = always ON.	0	0	100	min	S	YES
DIA	Assign digital input for immediate external alarm: - 1 = serial digital input; 0 = function disabled; 34 = digital input 4 (S4/D); 35 = digital input 5 (S5/D); 39 = digital input 1 (ID1); 40 = digital input 2 (ID2); 41 = digital input 3 (ID3).	0	-1	41	-	S	NO
DOb	Assign alarm digital output - see DOA	5	0	6/7	-	S	NO
Hb	Buzzer: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES

Delayed external alarm (par. A6, A11)

The behavior is similar to the immediate external alarm, with the difference that it is possible to set an activation delay using parameter A11. If the delay is set to 0, the alarm is for indication only.

Code	Description	Def.	Min	Max	UOM	User	User terminal
A6	Solenoid/compressor control configuration during external alarm (immediate or delayed): 0 = always OFF; 1-99 = minutes ON (Toff = 15 minutes fixed); 100 = always ON.	0	0	100	min	S	YES
A11	Delay time for delayed external alarm (0 = signal-only alarm)	0	0	240	min	S	YES
DIb	Assign delayed external alarm digital input - see DIA	0	-1	41	-	S	NO
DOb	Assign alarm digital output - see DOA	5	0	6/7	-	S	NO
Hb	Buzzer: 0 = disabled; 1 = enabled.	1	0	1	-	S	YES

In the case of a delayed alarm, the contact must remain open for a time longer than A11. If the contact closes during the A11 countdown, the alarm is not triggered and the countdown is canceled. If a new alarm condition occurs, the countdown will restart from zero.

9.3.5 Valve end-of-travel alarm (par. P14)

If the valve remains in a position above 90% for more than 25 minutes with superheat above the set point, or below 10% for the same time with superheat below the set point, parameter P14 can be set to enable/disable the electronic valve blocked alarm bLo.

Code	Description	Def	Min	Max	UOM	User	User terminal
P14	Enable valve end-of-travel alarm ('blo'): 0 = signal disabled; 1 = signal enabled.	1	0	1	-	M	YES

9.3.6 Alarm communication from secondary to main (par. Ar)

If there is an alarm on one of the secondary controllers in the network, the main controller can be enabled to display an alarm nx, where "x" is the number of the secondary device with the alarm.

Code	Description	Def	Min	Max	UOM	User	User terminal
Ar	Signal alarms from secondary to main: 0 = not enabled; 1 = enabled.	1	0	1	-	S	NO

9.3.7 Maintenance alarm

The MPX controller can count the time that elapses since maintenance was last carried out, and signal a maintenance request alarm.

Code	Description	Def	Min	Max	UOM	User	User terminal
HMP	Unit operating hour threshold (in thousands)	0	0	45	h*1000	S	NO
HMr	Reset operating hours and maintenance warnings **(Caution: irreversible operation)**	0	0	1	-	S	NO
HMc	Threshold for number of days until next unit maintenance	0	0	3650	giorni	S	NO

Two different maintenance thresholds can be set using parameters HMc in days and HMP in thousands of hours. When one of the set thresholds is exceeded, a maintenance request alarm Src is signalled. Alarm SrC is reset manually by resetting the operating hours using parameter HMr. Parameter HMr can be used to reset the count of operating hours since maintenance was last carried out even if the alarm has not been activated. If the operating hour threshold HMP=0 (default), the alarm is disabled.

Notice: the maintenance alarm can only be activated on models fitted with RTC and with the clock set correctly.

MPXPRO signals inconsistencies between relay and load or load degradation through two categories of diagnostic alarms:

- Failure to activate/deactivate (Lf2, Lf3, Lf4): these indicate an inconsistency between the logical state of the relay and the current measured with respect to the fixed threshold of 100 mA. The alarm identifies a disconnected or faulty load (relay ON and current < 100 mA) or a stuck relay contact (relay OFF and current > 100 mA). The delay for these notifications is configurable via parameters Et2 to 4.
- Load out-of-range (Lr2, Lr3, Lr4): these alarms signal deviations in current from the set limits. The alarm is activated if the current falls below the minimum threshold (EL2 to 4) or exceeds the maximum (EU2 to 4) for a time longer than the delay Et2 to 4. This helps detect progressive component degradation or operational anomalies before total failure.

Code	Description	Type	Troubleshooting	Action
Lfy (*)	Load failure on relay y	Alarm	-	Load faulty or disconnected (relay closed AND current < 100 mA)
-	Relay stuck (relay open AND current > 100 mA)	Signal only.		
Lry (*)	Relay y out-of-range	Alarm	Current outside the threshold	Signal only.
CfL	Config. parameter error	Alarm	General inconsistency in the current sensor settings.	Signal only.

Tab. 9.d

(*) y=2, 3, 4 to indicate the associated relay

The Lf (load failure) and Lr (out-of-range) alarms are automatically reset as soon as the error has been resolved or the relay is deactivated.
If parameter Ety (y=2, 3 or 4) is set to 0, relay failure diagnostics are disabled.

10. TROUBLESHOOTING

Display	Description	Possible cause
AtS	Autostart during pump down	Startup alarm during pump down: - check that the start delay time after valve opening is correct (par. c8)
bLo	Valve blocked	Valve blocked: - check that the valve is working correctly - check that the alarm is enabled correctly (par. P14) - check the correct connection and configuration of the probes
CUt	High condensing temperature warning	High condensing temperature warning: - check the condensing temperature probe - check the condensing temperature alarm threshold (par. Ac, AE) - check that the alarm delay is correct (par. Acd)
CfA	Analog output configuration error	Analog output configuration error: - check the settings of parameters /A*
CfD	Digital input configuration error	Analog input configuration error: - check the settings of parameters DI*
CFO	Digital output configuration error	Digital output configuration error: - check the settings of parameters DO*
CfL	Warning: power consumption parameter configuration error	Warning: power consumption parameter configuration error: - check the settings of parameters nE* and nL*
CHt	High condensing temperature alarm	High condensing temperature alarm: - check the condensing temperature probe - check the condensing temperature alarm threshold (par. Ac, AE) - check that the alarm delay is correct (par. Acd) - check that the condenser is free
CUt	High condensing temperature warning	High condensing temperature warning: - check the condensing temperature probe - check the condensing temperature alarm threshold (par. Ac, AE) - check that the alarm delay is correct (par. Acd) - check that the condenser is free
dA	Delayed alarm from external contact	Delayed alarm: - check the connected external devices - check the settings of parameters DIA and rIA - check the connection to the input set for DIA - check whether the connector associated with DIA is defined as NO or NC (par. rIA) - check that the delay time set for parameter A7 is correct
dE3	Valve motor error	Valve motor error: - check whether the valve type is compatible - check the connection of the electronic valve - check whether the valve is blocked
dE5	Emergency valve closure warning	Emergency valve closure warning: - check the valve size - check the connection of the electronic valve - check whether the valve is blocked
dEA	Defrost ended early	Defrost duration too short: - check the defrost settings - check the assignment of the early defrost probe and the relative threshold (par. dET, dEP)
dor	Door open for too long	Door alarm: - check the settings of parameters DIE and rIE - check the connection to the input set for DIE - check whether the connector associated with DIE is defined as NO or NC (parameter rIA) - check that the delay time set for parameter Tdoor is correct
E1	Probe S1 fault	Probe 1 error: - check the setting of /P1 for probe S1 - check that the probe is connected correctly and not broken
E2	Probe S2 fault	Probe 2 error: - check the setting of /P1 for probe S2 - check that the probe is connected correctly and not broken
E3	Probe S3 fault	Probe 3 error: - check the setting of /P1 for probe S3 - check that the probe is connected correctly and not broken
E4	Probe S4 fault	Probe 4 error: - check the setting of /P1 and /P2 for probe S4 - check that the probe is connected correctly and not broken
E5	Probe S5 fault	Probe 5 error: - check the setting of /P1 and /P2 for probe S5 - check that the probe is connected correctly and not broken
E6	Probe S6 fault	Probe 6 error: - check the setting of /P3 for probe S6 - check that the probe is connected correctly and not broken - check the limits for active probes
E7	Probe S7 fault	Probe 7 error: - check the setting of /P4 for probe S7 - check that the probe is connected correctly and not broken - check the limits for active probes
E8	Probe S8 fault	Probe 8 error: - check the setting of /P5 for probe S8 - check that the probe is connected correctly and not broken - check the limits for active probes
E11	Probe S11 fault	Probe 11 error: check the serial connection to the supervisor
E12	Probe S12 fault	Probe 12 error: check the serial connection to the supervisor
E13	Probe S13 fault	Probe 13 error: check the serial connection to the supervisor
E14	Probe S14 fault	Probe 14 error: check the serial connection to the supervisor

Display	Description	Possible cause
Ed1	Excessive defrost duration	Excessive defrost duration: - check the defrost settings (par. dP1, dt1) - check the positioning of the defrost probe
Ed2	Excessive defrost duration on second evaporator	Excessive defrost duration on second evaporator: - check the second evaporator defrost settings (par. dP2, dt2) - check the positioning of the second evaporator defrost probe
EHI	High power supply voltage	Power supply voltage too high: - check the electrical connections - check the power supply voltage - check the correct setting of the alarm threshold (par. uHi, uHo)
ELO	Low power supply voltage	Power supply voltage too low: - check the electrical connections - check the power supply voltage - check the correct setting of the alarm threshold (par. uLi, uLo)
Etc	Real time clock not updated	Date/time alarm: - check the date and time settings
GHI	Generic function: MAX threshold exceeded alarm	Generic function maximum threshold alarm: - check the connection to the generic alarm digital input (par. Dis) - check the probes associated with the generic function (par. GFA_1 and GFA_2) - check the value of the control probe thresholds (par. GFA_Hth, GFA_D) - check that the alarm delay time is correct (par. GFA_de)
GLO	Generic function: MIN threshold exceeded alarm	Generic function minimum threshold alarm: - check the connection to the generic alarm digital input (par. Dis) - check the probes associated with the generic function (par. GFA_1 and GFA_2) - check the value of the control probe thresholds (par. GFA Lth, GFA_D) - check that the alarm delay time is correct (par. GFA_de)
GPE	Custom gas parameter error	Gas parameter error: - check the custom gas parameters
HA	Type HA HACCP alarm	HACCP alarm during operation: - check the alarm threshold (par. AH, AHA) - check the set delay (par. Htd)
HF	Type HF HACCP alarm	HACCP alarm after power failure: - check the alarm threshold (par. AH, AHA) - check that the alarm is enabled (par. Htd)
HI	High temperature	High temperature alarm: - check whether the high temperature threshold is set as absolute or relative (par. A1) - check the alarm threshold (par. AH, AHA)
HI2	High temperature 2	High temperature alarm with double thermostat: - check whether the high temperature threshold is set as absolute or relative (par. A2) - check the alarm threshold (par. AH2, AHA2)
IA	Immediate alarm from external contact	Immediate alarm: - check the connected external devices - check the settings of parameters DIA and rIA - check the connection to the input set for DIA - check whether the connector associated with DIA is defined as NO or NC (parameter rIA)
LfA	Anti-sweat activation warning	Anti-sweat activation warning: - check the connected external devices - check the settings of parameters DOQ and rOQ
Lfb	Compressor activation warning	Compressor activation warning: - check the connected external devices - check the settings of parameters DOA and rOA
Lfc	Compressor activation warning 2	Compressor activation warning 2: - check the connected external devices - check the settings of parameters DOk and rOk
Lfd	Defrost activation warning	Defrost activation warning: - check the connected external devices - check the settings of parameters DOG and rOG
Lff	Fan activation warning	Fan activation warning: - check the connected external devices - check the settings of parameters DOI and rOI
Lfl	Light activation warning	Light activation warning: - check the connected external devices - check the settings of parameters DOE and rOE
LO	Low temperature	Low temperature alarm: - check whether the low temperature threshold is set as absolute or relative (par. A1) - check the alarm threshold (par. AL, ALA)
LO2	Low temperature 2	Low temperature alarm with double thermostat: - check whether the low temperature threshold is set as absolute or relative (par. A2) - check the alarm threshold (par. AL2, ALA2)
LOP	Low evaporation pressure	Low evaporation pressure: - check that the minimum evaporator temperature threshold is expressed in degrees (par. PL1) - check the PID integral parameter (par. PL2) - check that the LOP alarm delay time is correct (par. PL3)
LP	Low suction temperature	Low suction temperature: - check the pressure probe
LSH	Low superheat	Low superheat: - check the setting of the minimum superheat threshold (par. P7) - check the correct connection and configuration of the probes - check that the valve is not blocked - check the refrigerant charge - check the PID integral parameter (par. P8) - check that the LSH alarm delay time is correct (par. P9)
LSA	Low suction temperature	Low suction temperature: - check the set threshold (par. P11) - check that valve closing is enabled (par. P10) - check that the LSA alarm activation delay time is correct (par. P12)

Display	Description	Possible cause
MA	Communication error with main (secondary only)	Communication error: - check that the controller is set as secondary (par. In = 0) - check the serial connection
MOP	High evaporation pressure	High evaporator pressure: - check that the fans are working - check that the valve is not blocked - check the compressor capacity and the cooling request - check that the minimum evaporator temperature threshold is expressed in degrees (par. PM1) - check the PID integral parameter (par. PM2) - check that the MOP alarm delay time is correct (par. PM3)
Mss	No suction probe	No suction probe: - check the connection of the suction probe - check that the suction probe is working
n1	Alarm on unit 1 (main only)	Alarm on secondary: check the alarm on secondary 1
n2	Alarm on unit 2 (main only)	Alarm on secondary: check the alarm on secondary 2
n3	Alarm on unit 3 (main only)	Alarm on secondary: - check the alarm on secondary 3
n4	Alarm on unit 4 (main only)	Alarm on secondary: check the alarm on secondary 4
n5	Alarm on unit 5 (main only)	Alarm on secondary: check the alarm on secondary 5
n6	Alarm on unit 6 (main only)	Alarm on secondary: check the alarm on secondary 6
n7	Alarm on unit 7 (main only)	Alarm on secondary: check the alarm on secondary 7
n8	Alarm on unit 8 (main only)	Alarm on secondary: check the alarm on secondary 8
n9	Alarm on unit 9 (main only)	Alarm on secondary: check the alarm on secondary 9
nFc	Warning: too frequent writes to NFC memory	Too frequent writes to NFC memory: - check that the NFC memory is not being written too frequently
PD	Pump down duration alarm	Pump down duration alarm: - check the end pump down condition (par. c10) - check the maximum end pump down time (par. cPt) - check that the low pressure switch is working
rE	Control probe alarm	Control probe: - check the probe assignments (par. /FA, /FC) - check the composition of the virtual probe (par. /4) - check that the outlet and intake probes used to calculate the virtual probe are correctly connected and not faulty
rEt	Warning: too frequent memory writes	Too frequent parameter writes: - check whether frequent parameter writes have occurred (e.g. configuration loading)
SrC	Maintenance request	Maintenance request: - check the maintenance schedule - contact technical support
u1	Communication error with secondary 1 (only on main)	Communication error: - check the serial settings on secondary 1 - check the serial connection with secondary 1
u2	Communication error with secondary 2 (only on main)	Communication error: - check the serial settings on secondary 2 - check the serial connection with secondary 2
u3	Communication error with secondary 3 (only on main)	Communication error: - check the serial settings on secondary 3 - check the serial connection with secondary 3
u4	Communication error with secondary 4 (only on main)	Communication error: - check the serial settings on secondary 4 - check the serial connection with secondary 4
u5	Communication error with secondary 5 (only on main)	Communication error: - check the serial settings on secondary 5 - check the serial connection with secondary 5
u6	Communication error with secondary 6 (only on main)	Communication error: - check the serial settings on secondary 6 - check the serial connection with secondary 6
u7	Communication error with secondary 7 (only on main)	Communication error: - check the serial settings on secondary 7 - check the serial connection with secondary 7
u8	Communication error with secondary 8 (only on main)	Communication error: - check the serial settings on secondary 8 - check the serial connection with secondary 8
u9	Communication error with secondary 9 (only on main)	Communication error: - check the serial settings on secondary 9 - check the serial connection with secondary 9
uGH	Generic function upper threshold exceeded warning	Generic warning 1: - check the generic function settings (par. GFA_WHth) - check the probes associated with the generic function (par. GFA_1 and GFA_2)
uGL	Generic function upper threshold exceeded warning	Generic warning 1: - check the generic function settings (par. GFA_WLth) - check the probes associated with the generic function (par. GFA_1 and GFA_2)
WDo	Open door warning	Open door warning: - check that the door is correctly closed - check the closed door contact - check the door contact settings (par. DIE, DIP)

Tab. 10.e

11. APPENDIX

A.1 Comparison between MPXPRO versions to facilitate rewiring

Caution: before performing any operations on the control board, disconnect the main power supply by turning the main switch in the electrical panel OFF.

When replacing previous MPXPRO versions (MX302), it is essential to pay attention to the following points:

- terminals 3, 5 and 6, 7: default configuration change in digital outputs, the solenoid/compressor and light outputs are reversed (terminal J19);
- terminal 4: NC contact not available for solenoid/compressor digital output;
- terminal 23: Main/secondary network not compatible (t-LAN -> RS485, terminal J12);
- terminal 24: HMI user interface not compatible (t-LAN -> RS485, terminals J9 and J10);
- terminals 27, 29...33 Digital inputs: the new controller features 3 digital inputs plus two multifunction inputs (terminals J2, J4, and J6);
- terminals 32...37: probes S1...S5 must all be of the same type. Different types can be connected to S6, S7, and S8 (terminals J1, J2, and J3);
- terminals 60...63: support terminal (N) introduced for PWM Vac valve power supply (terminal J14);
- terminals 64, 65: PWM Vdc valve not available.

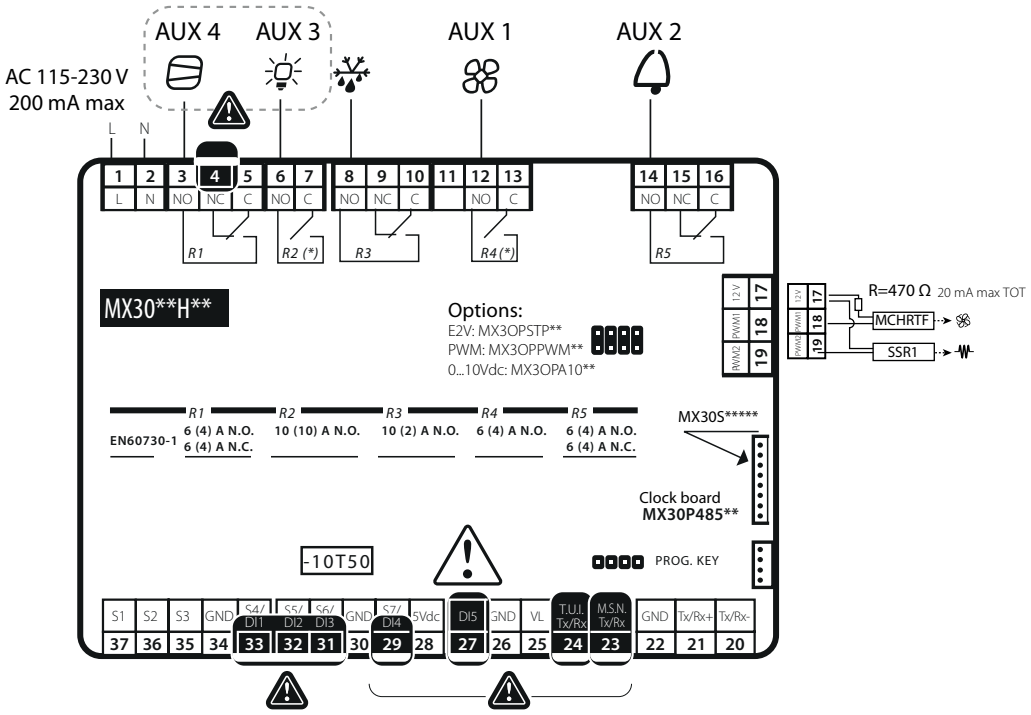


Fig. 11.a

Terminal		Description
1	L	Power supply: 230 Vac, 50mA max. (mod. MX30***E**) 115 Vac, 100mA max. (mod. MX30***A**)
2	N	
3	NO	Relay 1: EN60730-1: 6(4)A N.O.,6(4)A N.C. 2(2)A C.O.
4	NC	UL: 6A res 240Vac N.O. / N.C.
5	C	1/2Hp 240Vac N.O. 1/6 Hp 120Vac N.O
6	NO	Relay 2: EN60730-1: 10(10)A N.O.
7	C	UL: 10A res 1Hp 240/120 Vac N.O. *5-relay model only*
8	NO	Relay 3: EN60730-1: 10(2)A N.O UL: 10A res 240Vac
9	NC	
10	C	
11	Not used	
12	NO	Relay 4: EN60730-1: 6(4)A N.O.
13	C	UL: 6A res 240Vac; 1/2Hp 240Vac - 1/6Hp 120Vac *5-relay model only*
14	NO	Relay 5: EN60730-1: 6(4)A N.O., 6(4)A N.C.
15	NC	UL: 6A res 240Vac N.O. / N.C.
16	C	1/2Hp 240Vac N.O; 1/6Hp 120Vac N.O.
17	+12V	Power supply
18	PWM1	PWM1 open collector output: 12 Vdc, 20 mA MAX
19	PWM2	PWM2 open collector output: 12 Vdc, 20 mA MAX

Terminal		Description
20	Tx/Rx-	Connection to RS485 supervisory network - CAREL and Modbus® protocol – main controller only (use shielded cable)
21	Tx/Rx+	
22	GND	
23	M.S.N Tx/Rx	Connection to local main/secondary tLAN (Main-Secondary Network). Use a shielded cable.
26	GND	
24	Tx/Rx	Local tLAN connection for user terminals and remote display
25	VL	
26	GND	
26	GND	Multifunctional digital input
27	DI5	
28	DC 5 V	Multfunction analogue/digital inputs: • NTC, PTC, PT1000, NTCL243 probe • 0…5 Vdc ratiometric probe • 0…10 Vdc analogue input • 4…20 mA analogue input • Multifunctional digital input
29	S7/DI4	
30	GND	
32	S5/DI2	
33	S4/DI1	
34	GND	NTC/PTC/PT1000/NTCL243 probes
35	S3	
36	S2	
37	S1	

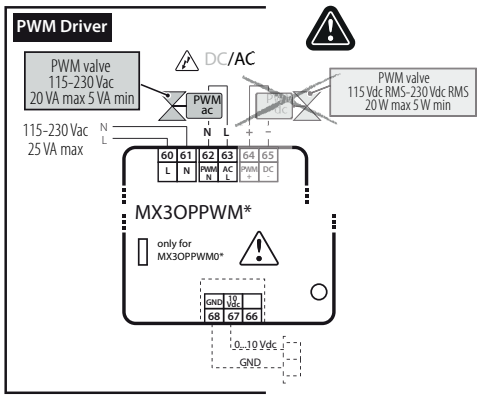


Fig. 11.b

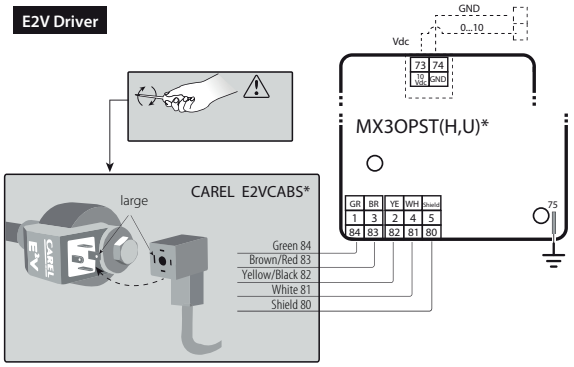


Fig. 11.c

Terminal		Description
60	L	Power supply: 115…230 Vac, 50/60 Hz, 25 VA MAX
61	N	
62	N	PWM valve Vac power supply: 115…230 Vac, 50/60 Hz, 5 VA MIN, 20 VA MAX
63	L	
64	+	PWM valve Vdc power supply: 105…230 Vdc RMS, 5 W MIN, 20 W MAX
65	-	
66	Not used	
67	0-10 Vdc output	Control signal for modulating actuators: Max error 2% fs, max load 2.2 kΩ.
68	GND	

Terminal		Description
73	0…10 Vdc output, 4.5 mA MAX	Control signal for modulating actuators: Maximum error 2% fs, maximum load 2.2 kΩ
74	GND	
75	Functional earth	
80	Shield	Connection to the CAREL E2V valve with E2VCABS600 shielded cable
81	White	
82	Black/yellow	
83	Brown/red	
84	Green	

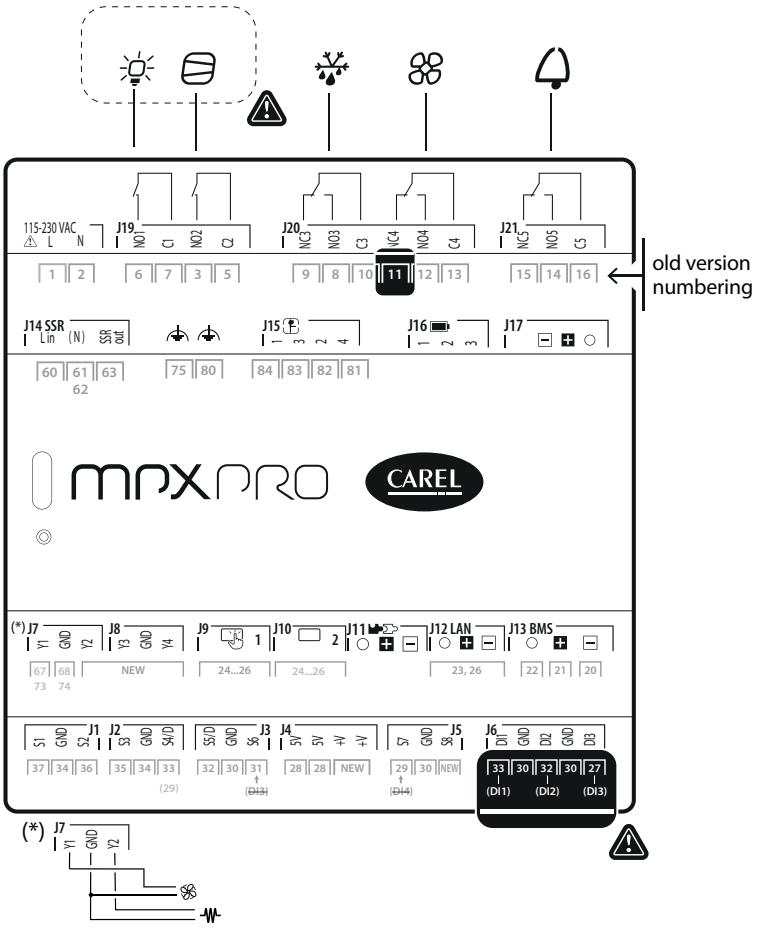


Fig. 11.d

A.2 Differences between parameters in different MPXPRO vers.

The table below shows the parameters that have a different name or function between MPXPRO versions. The parameters not listed in this chapter have retained the same name and the same function.

Old version	New version	Notes
/c1, ..., /c7: parameters used to correct probes S1...S7, respectively	**/cA, /cAF, ..., /co:** parameters used to correct the reading of the probe associated with a function.	Different analogue input management
/L6, /L7, /U6, /U7: values associated with probes S6 and S7.	**/L..., /U...:** values associated with functions	
/P1 - Probe type for group 1 (S1, S2, S3): 0 = NTC –50T90 °C ; 1 = PTC –50T150 °C; 2 = PT1000 –50T150 °C; 3 = NTC L243 –50T90 °C.	**/P1 – Probe type for group 1 (S1, S2, S3, S4, S5):** 0 = PT1000 –50T150 °C; 1 = NTC –50T90°C; 5 = NTC-HT –15T150°C.	Probe type and different groups
/P2 – Probe type for group 2 (S4, S5): 0 = NTC –50T90 °C; 1 = PTC –50T150 °C; 2 = PT1000 –50T150 °C; 3 = NTC L243 –50T90.	**/P2 - Group 1 inputs used as digital inputs:** 0 = none; 1 = S4/D; 2 = S4/D e S5/D.	
A4, A5, A10, A11, A12: assignment to the function input	**DIa, ..., DIZ:** assignment to the function input	Different digital input management
A8: assignment to the virtual digital input of the function	**DIA...DIZ:** assignment to the virtual digital input of the function	
Hr1, ...Hr5: assignment to the logic input	**rIA, ..., rIZ:** assignment to the logic input	
Fixed analogue outputs based on the function	**/Aa.../Ag; /P6.../P9:** function assignment to the output and output type selection	Different analogue output management
F9, PWM fan control selection	Not present	
H10, H11: only solenoid/compressor and evaporator fans have configurable NO/NC logic	roA...rot: all functions have configurable NO/NC logic	Different digital output management
OFF: 0 = On; 1 = Off.	**ON:** 0 = Off; 1 = On.	Different On/Off management
On/Off command from supervisor always active	On/Off command from supervisor always active	
AL, AH, AL2, AH2: same alarm threshold for both absolute and relative alarms	**AL, AH, AL2, AH2, ALA, AHA, ALA2, AHA2:** separate alarm thresholds for absolute and relative alarms	Separate relative and absolute temperature alarm thresholds
Baudrate, parity and stop bits fixed	**H1, H2:** Baudrate, parity and stop bits selectable by parameter	BMS Configuration
H0: 1...207	**H0:** 1...247	
H0 secondary: 1...9	**H0 secondary:** 2...247, consecutive at main address	
H2, H3	**H2** different meaning, **H3** not present	Remote control
P1, electronic valve: 0 = not used; 1 = PWM; 2 = E2V Carel; 3 = 0-10 V for refrigerant control 4 = PWM for refrigerant control; 5 = E2V Carel for refrigerant control.	**P1, electronic valve:** 0 = not used; 1 = PWM; 2 = E2V/ E3V Carel; 3 = 0-10V modulation for refrigerant flow control 4 = PWM valve modulation for refrigerant flow control 5 = Carel E2V/E3V valve modulation for refrigerant flow control 7 = Carel E4V..E7V valve modulation for refrigerant flow control 8 = 0-10 V modulation	Electronic valve configuration
PH, refrigerant type: 0 to 40, default 404A	**PH, refrigerant type:** 0 to 47, default R744	
PSb, PMu in steps	PSb, PMu in %	
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; 5 = hot gas by temperature; 6 = hot gas by time.	**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; d0 = 5 d0 = 6 **Notice:** from version 1.2.1	Different defrost management
dC, defrost time base	Not present	
dHG, hot gas defrost type: 0 = equalising valve normaly closed; 1 = equalising valve normaly open;	**dHG,** Hot gas valve inversion duration	
HSc, HSS	Not present	Differentparameters configuration management
H4, buzzer: 0 = enabled; 1 = disabled.	**Hb, buzzer:** 0 = disabled (default); 1 = enabled.	Buzzer

Tab. 11.a

12. RELEASE NOTES

Software version	Manual version	Description
0.5.2	0.1 - 13.09.2024	First release (preliminary)
1.1.0	1.0 - 09.07.2025	First release
1.2.4	1.1 - 15.06.2026	Second release

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MPXPRO +0300160EN rel. 1.1 - 15.06.2026