ENG

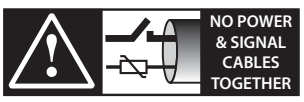
iJM

Electronic controller for merchandisers

USER MANUAL

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS



READ CAREFULLY IN THE TEXT!

iJM

+0300101EN - ENG

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www.carel.com

GENERAL WARNINGS

CAREL bases the development of its products on decades of experience in HVAC, on continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. CAREL and its subsidiaries/affiliates nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques. The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, act as a consultant for the successful commissioning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system. The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.carel.com. Each CAREL product, in relation to its advanced level of technology, requires setup/configuration/programming/commissioning to be able to operate in the best possible way for the specific application. Failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases. Only qualified personnel may install or carry out technical service on the product. The customer must only use the product in the manner described in the documentation relating to the product. In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:

- prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corrosive minerals that may damage the electronic circuits. any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual;
- do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual;
- do not attempt to open the device in any way other than described in the manual.
- do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged;
- do not use corrosive chemicals, solvents or aggressive detergents to clean the device;
- do not use the product for applications other than those specified in the technical manual.

All of the above suggestions likewise apply to the controllers, serial cards, programming keys or any other accessory in the CAREL product portfolio. CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning. The technical specifications shown in the manual may be changed without prior warning. The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, available on the website www.carel.com and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subsidiaries/affiliates be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or impossibility to use the product, even if CAREL or its subsidiaries/affiliates are warned of the possibility of such damage.

DISPOSAL

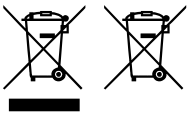


Fig. 1 Fig. 2

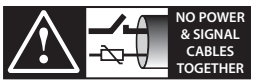
INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

The product is made up of metal parts and plastic parts. In reference to European Union directive 2002/96/EC issued on 27 January 2003 and related national legislation, please note that:

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

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

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



READ CAREFULLY IN THE TEXT!

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

Key to the symbols:

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: IMPORTANT

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.

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1. INTRODUCTION

iJM is the range of CAREL electronic controllers designed for commercial refrigeration applications, specifically merchandisers such as beverage coolers and chest freezers for industrial ice cream. The range comprises SMALL formats, which allow different mounting methods: FRONT PANEL mounting with built-in display or SPLIT mounting, with or without REMOTE HMI DISPLAY. All models come with 115 - 230 Vac switching power supply and NFC (Near Field Communication) connectivity. All standard iJM display interfaces use buttons with a capacitive touch screen.

A vast catalogue of options for integration into the device is available across the entire iJM range:
- Bluetooth to interact in real time with the chiller and access the data logs stored on the controller. The Bluetooth antenna, built into the iJM faceplate, allows connection with the CAREL Applica app for service and Controlla app for end users. Furthermore, all iJM models equipped with the Bluetooth option are compatible with "Vision IoT" services.
- Modbus over RS485 for connection to Carel or third-party supervisory systems (no external converter needed).
- Serial VCC output to directly drive a VCC (variable capacity compressor) via serial link, without external adapters.
- Modulating outputs (0-10 V/PWM) to directly drive modulating loads such as frequency-controlled VCC compressors, dimmable lights or variable-speed fans.
- Safety package with high and low power supply voltage (HLV) readings and zero crossing (ZC) function for the relays.
- RTC clock
- Different combinations of colours and keypads for the display.

The entire iJM range is integrated into the following CAREL support software and apps:
- Spark software for OEM technical departments; connection via RS485, BMS or port ID2 with specific converters.
- Applica Desktop software for OEM technical departments; connection via RS485, BMS or port ID2 with specific converters.
- Sparkly software for larger OEM production lines; connection via RS485.
- Applica for technical service in the field; local connection via NFC and BT.
- Controlla app for end users; local connection via BT.
- Replica app, for smaller OEM production lines; connection via NFC

The iJM models equipped with the Bluetooth option are compatible with "Vision IoT" apps.
- "Factory association" app, to register the cooler on the bottler's IoT portal; this operation is called "provisioning". This app is used on the OEM production line to read the QR on the iJM product label.
- "EBest-IOT SmartCooler" App, to send iJM logs to the bottler's IoT portal. This app is used by the sales representatives that visit the stores regularly.

1.1 Functions and main features

The functions available on the iJM range are the same as on the iJF range, with the exception of combined humidity and temperature control. In addition, the following features are also available, specific for these applications:
- Automatic ECO mode based on door openings (merchandisers with doors)
- Automatic ECO mode via RTC programmer
- Automatic ECO mode based on the curtain switch (open-front merchanidisers)
- Manual Summer/Winter changeover
- Mitigation algorithm
- Automatic pull down

The iJM range has been designed to offer maximum flexibility through the use of modular hardware.
Main features of the basic versions:

- SMALL models, 4 inputs and up to 4 relays.
- Panel version with built-in display.
- Split version with remote display.
- Split version without remote display.
- 115-230 Vac +-10% (90-264 Vac) switching power supply.
- NFC connectivity.

Fully-integrated options:
- Bluetooth (with real time clock)
- Real time clock
- 1 RS485 serial port for supervisor with Modbus protocol
- 1 VCC serial port (*)
- 2 modulating outputs (0-10V/PWM/VCC by frequency) (*)
- High and low power supply voltage (HLV) readings and zero crossing (ZC) function.

(*) versions are mutually exclusive

The iJM range controllers come with different ingress protection ratings, as indicated by the last two digits in the part number.

1.2 Models and accessories

Below are the features of the iJM models, divided by format and mounting.
Each product group is identified by the first six digits in the part number, as shown in the explanatory diagram below.

I J M	*	*	A	*	*	* *	*	* * * *
Product name	Mounting: H = HMI; P = Panel; S = Split.	Size: L = Large; S = Small.	Reserved	Number of relays	Connectivity/ RTC: N = NFC; R = NFC, RTC; B = NFC, RTC, Bluetooth.	Hardware options: 00 = None; 01 = TTL; 02 = BMS; 04 = BMS, VCC via serial; 06 = BMS, 0-10V/ PWM/ VCC by frequency.	Packaging: S = Single; M = Multiple; 1, X = Custom single; 2, Y = Custom multiple.	Progressive number

Tab. 1

The iJM controllers come with different ingress protection ratings, depending on the chosen options and indicated by the last two digits in the part number, as shown in the table:

Part number	Coating
BCU**********00	No coating
BCU**********02	Electronic grade coating
BCU**********03	Curable conformal coating + Electronic grade coating

Tab. 1.a

Contact CAREL for details on the complete product part numbers available and the corresponding technical specifications.

1.2.1 SMALL controllers

FRONT PANEL mounting with built-in display

Fig. 1.a

P/N (first 6 digits)	Description
IJMPSA	Basic features: • 115/230Vac switching power supply; • NFC; • 2 probe inputs, 1 digital input, 1 multifunction input; • max 4 relays (2HP 8A 5A 5A); • plug-in, screw or fast-on terminals; • single or multiple pack; • black or white faceplate (*); • white or red digits (*); • 3 touch buttons. (*) Different colours available on custom models. Optional features: • Bluetooth with RTC; • RTC; • High and low power supply voltage (HLV) readings and zero crossing (ZC) function; • 1 RS485 serial port for supervision. Mutually-exclusive options: • 1 VCC serial port; • 2 modulating outputs (0-10V/PWM/VCC by frequency, selectable for each output);

Tab. 1.b

SPLIT mounting

Fig. 1.b

P/N (first 6 digits)	Description
IJMSSA	Basic features: • 115/230Vac switching power supply; • NFC; • 2 probe inputs, 1 digital input, 1 multifunction input; • max 4 relays (2HP 8A 5A 5A); • plug-in, screw or fast-on terminals; • single or multiple pack; • JST connector at front for connection to remote display. Optional features: • Bluetooth with RTC; • RTC; • High and low power supply voltage (HLV) readings and zero crossing (ZC) function; • 1 RS485 serial port for supervision. Mutually-exclusive options: • 1 VCC serial port; • 2 modulating outputs (0-10V/PWM/VCC by frequency, selectable for each output);

Tab. 1.c

Remote HMI terminal

Fig. 1.c

P/N (first 6 digits)	Description
IJMHSA	Basic features: • low voltage power supply from the controller; • NFC; • single or multiple pack; • mini JST terminal for connection to the controller, fixed screw or plug-in; • black or white faceplate (*); • white or red digits (*); • 3 touch buttons. (*) Different colours available on custom models. Optional features: • Bluetooth; • 1 multifunction input, fixed screw or plug-in terminal

Tab. 1.d

1.2.2 Accessories

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

Connector kit

Fig. 1.d

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

Tab. 1.e

Fixing brackets

Fig. 1.e

P/N	Description
BXOPZMBRC0002	bracket kit for panel version, multiple pack (20 pcs)
ACS00CK001602	bracket kit for HMI version, multiple pack (20 pcs)

Tab. 1.f

Cables

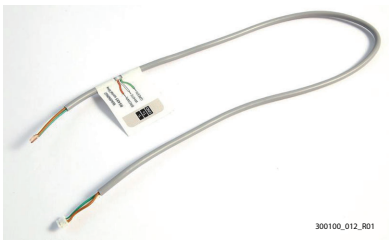


Fig. 1.f

P/N	Description
BXOPZC3000050	3-pin mini JST/free end cable, 50 cm (1 pc)
BXOPZC3S00250	3-pin mini jst/free end shielded cable, 250 cm (1 pc)

Tab. 1.g

Cables for HMI display

Fig. 1.g

P/N	Description
BXOPZC4000150	4-pin mini JST/mini JST cable, 150 cm (1 pc)
BXOPZC4000300	4-pin mini JST/mini JST cable, 300 cm (1 pc)
BXOPZC4010300	4-pin mini JST/free end cable, 300 cm (1 pc)

Tab. 1.h

Cables for VCC compressor inverter

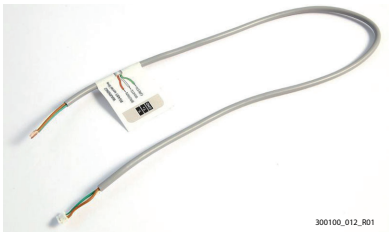


Fig. 1.h

P/N	Description
BXOPZC30E0100	3-pin mini JST/free end shielded cable for Embraco inverter, 100 cm (1 pc)
BXOPZC30E0104	3-pin mini JST/free end shielded cable for Embraco inverter, 100 cm (40 pc)
BXOPZC30S0100	3-pin mini JST/free end shielded cable for Secop inverter, 100 cm (1 pc)

Tab. 1.i

Adapter kits

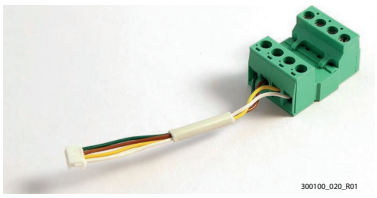


Fig. 1.i

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

Tab. 1.j

Converters

Fig. 1.j

P/N	Description
BXOPZIOWD0000	USB to 1-wire converter for digital input (DI2)
BXOPZI4850000	RS485 converter for TTL serial port
CVSTDUMOR0	USB/RS485 converter

Tab. 1.k

Gaskets

Fig. 1.k

P/N	Description
BXOPZMGKS0001	Rear panel mounting gasket - Split Small (10 pcs)

Tab. 1.l

1.2.3 Temperature sensors

Fig. 1.l

P/N	Type	Description	Range
NTC***HP0*	10 kΩ±1%@25 °C, IP67 β 3435	Temperature probe	-50 to 50°C (105°C in air)
NTC***HF01	10 kΩ±1%@25 °C, IP67 β 3435	Evaporator outlet temperature probe	-50 to 90°C strap-on
PT1060HP01	PT1000 Class B, IP67	Temperature probe	-50T105°C in air
PT1***HF01	PT1000 Class B, IP67	Evaporator outlet temperature probe	50T105°C in air

Tab. 1.m

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

Installation example with one evaporator

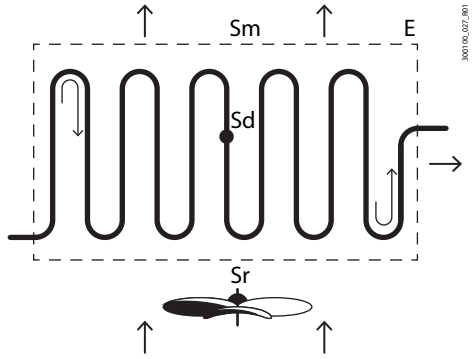


Fig. 1.m

Key:

Code	Description
Sm	Air off probe
Sr	Air on probe
Sd	Defrost probe
E	Evaporator

Tab. 1.n

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);

2.2 Small version for front panel mounting

2.2.1 Dimensions mm (inch)

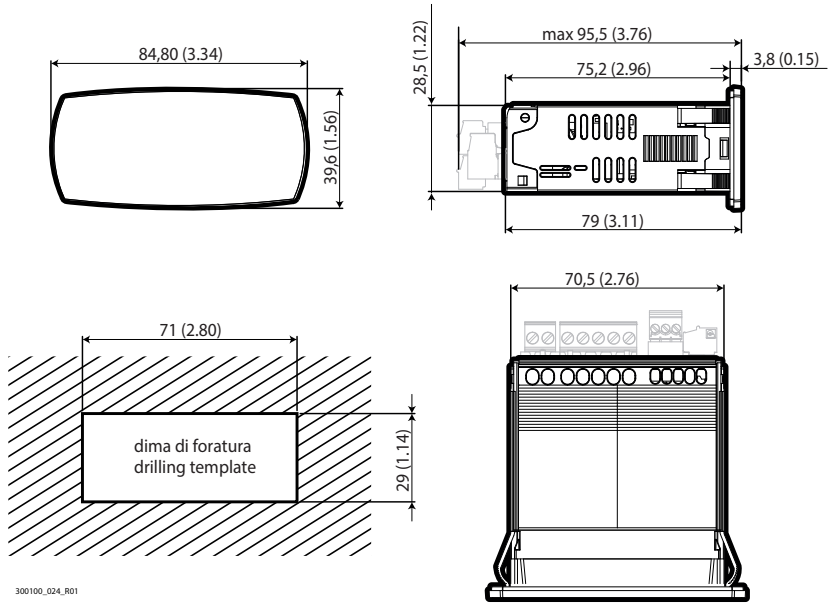


Fig. 2.a

2.2.2 Assembly

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

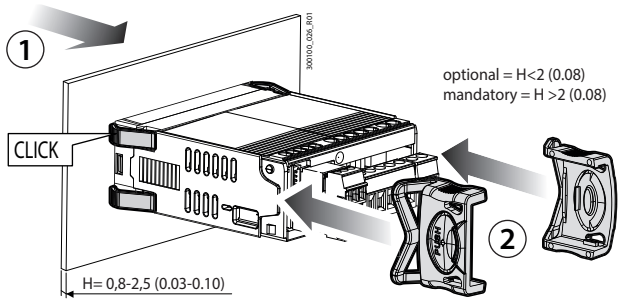


Fig. 2.b

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

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 product (0.8-2.5 mm / 0.03-0.10 in).

2.2.3 Removal

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

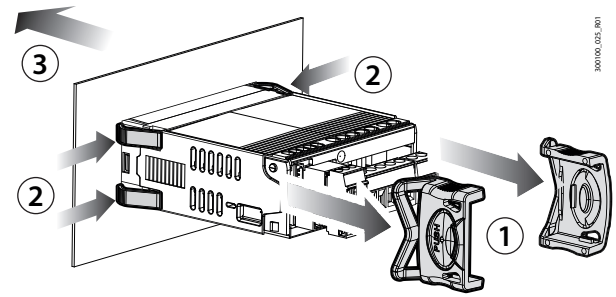


Fig. 2.c

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

2.3 Small version with SPLIT mounting

2.3.1 Dimensions - mm (in)

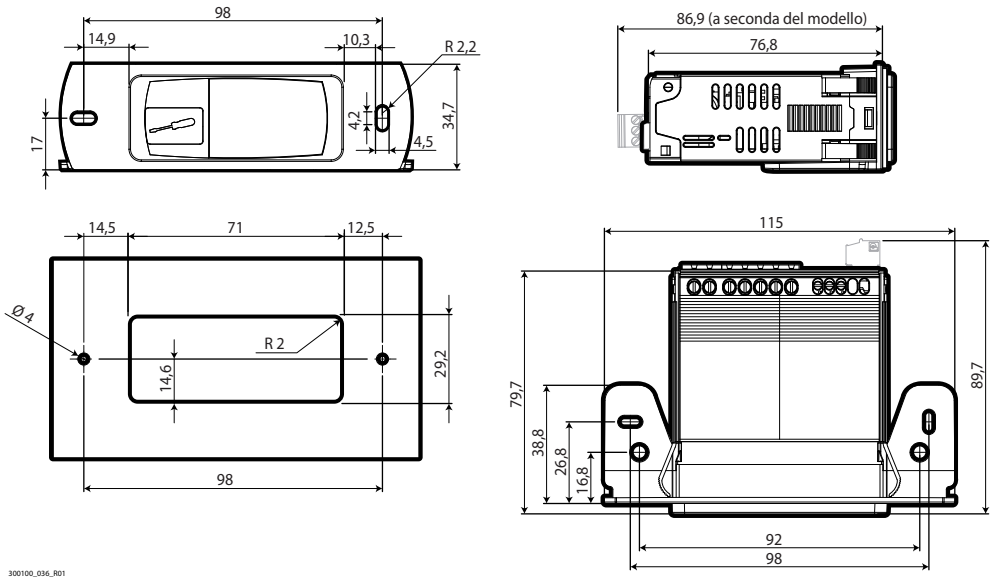


Fig. 2.d

2.3.2 Assembly

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

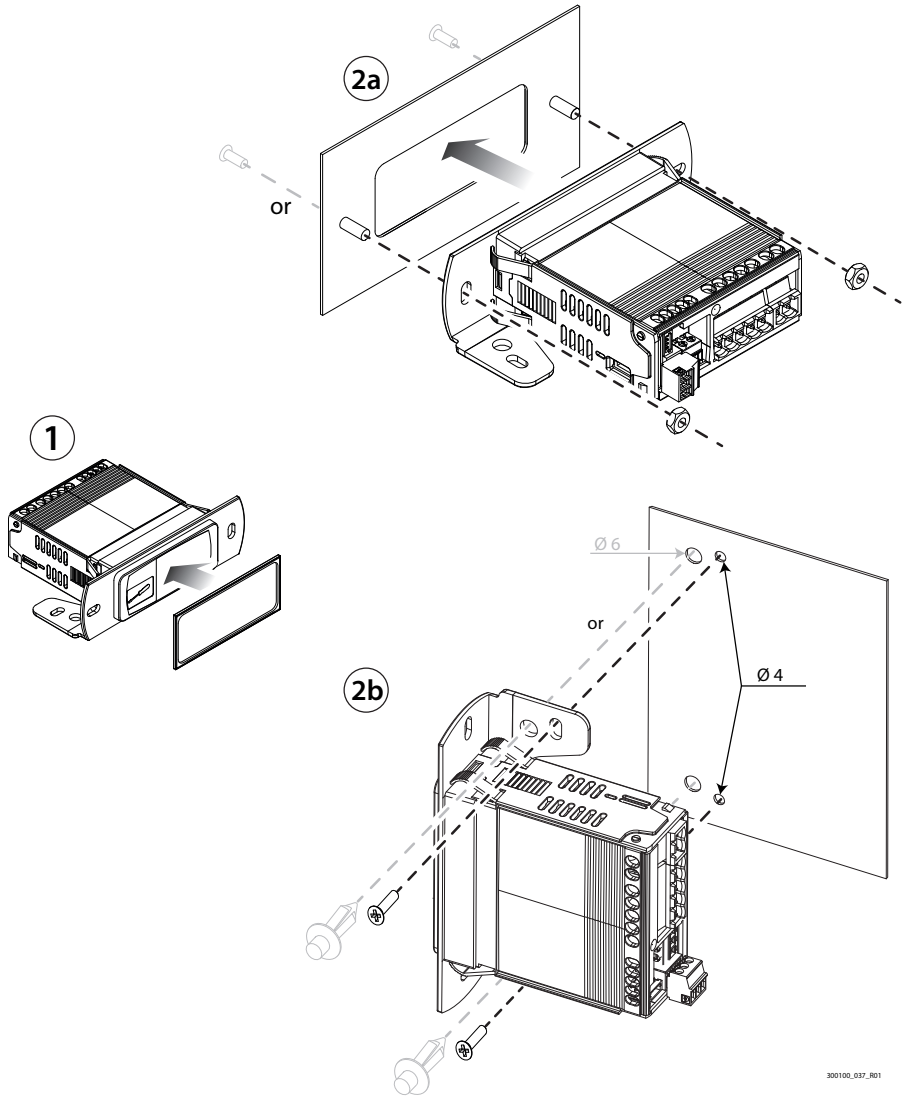


Fig. 2.e

1. Place the gasket on the front of the controller (for surface mounting only);
2. Place the controller over the drilling template or in the fixing position;
3. Tighten the fixing screws or insert the clips into the holes provided, as shown in the figure.

Caution: IP20 or IP45 front protection (with or without user interface connected, respectively) is guaranteed only if the following conditions are met:
- maximum deviation of the rectangular opening from flat surface: ≤ 0.5 mm (0.02 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 product (0.8-2.5 mm / 0.03-0.10 in).

2.3.3 Removal

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. unscrew the fixing screws or remove the clips.

2.4 Small version with remote HMI terminal

2.4.1 Dimensions - mm (in)

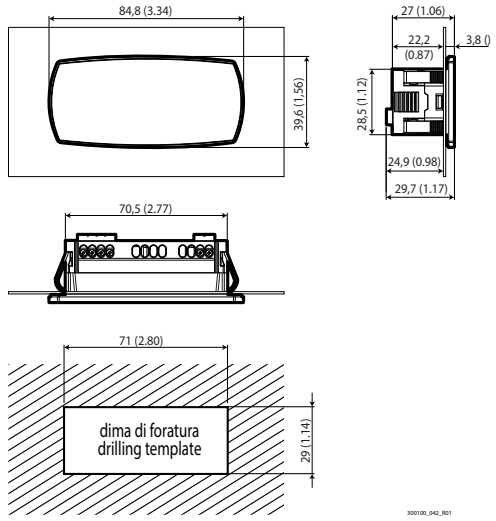


Fig. 2.f

2.4.2 Assembly

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

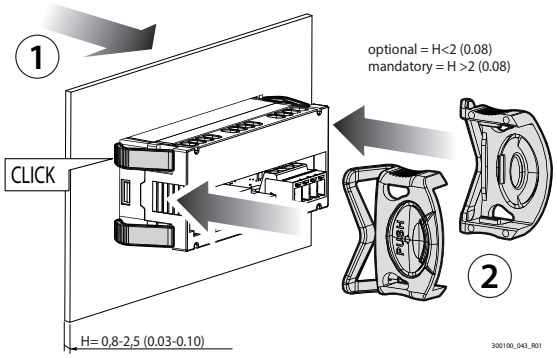


Fig. 2.g

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

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 product (0.8-2.5 mm / 0.03-0.10 in).

2.4.3 Removal

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 anchoring tabs on the controller;
3. exert slight pressure on the controller until it is removed.

2.4.4 HMI connection

Caution: disconnect the controller before carrying out any maintenance.

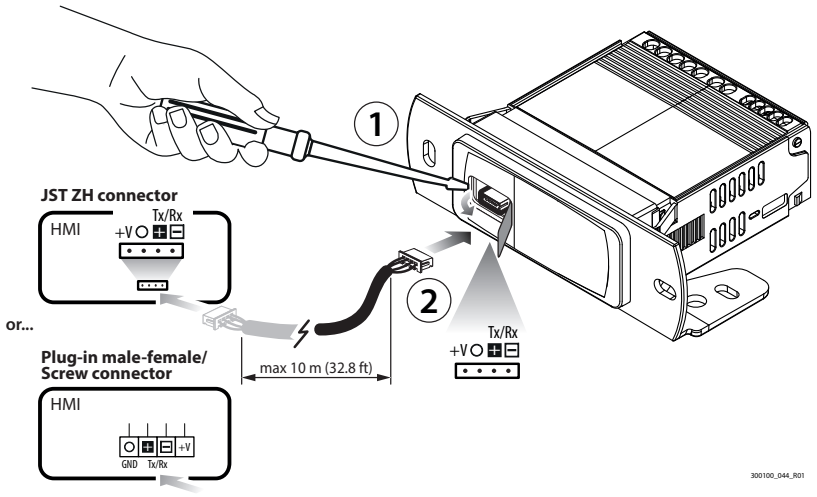


Fig. 2.h

Open the electrical panel and from the rear:
1. using a screwdriver, remove the rubber protection from the front of the Split controller;
2. connect the 4-wire cable to the mini JST connector on the controller;
3. connect the 4-wire cable to the mini JST or screw/plug-in connector on the user interface.

Caution: for HMIs with screw or plug-in terminals, respect the order of the wiring.

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

2.5 Description of the terminals

Small model

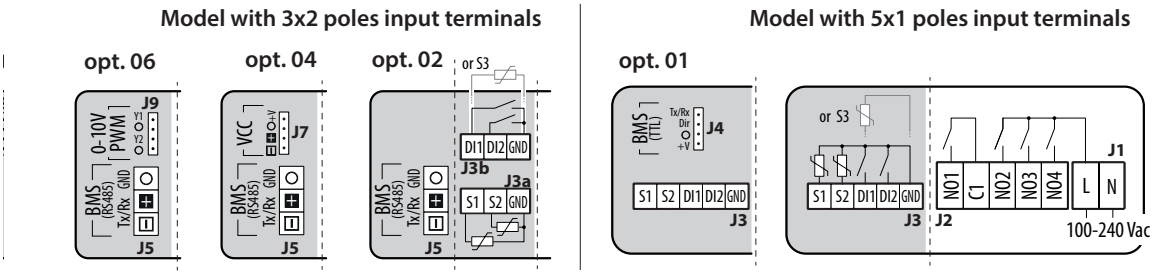


Fig. 2.i

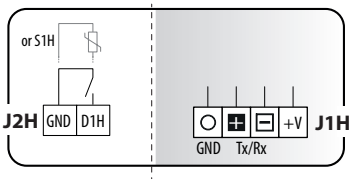
Ref.		Description
J1	L	Power supply
	N	
J2	NO1	Digital output (relay) 1
	C1	Common for relay 1
	NO2	Digital output (relay) 2
	NO3	Digital output (relay) 3
	NO4	Digital output (relay) 4
J3,	S1	Analogue input 1 (NTC, PTC or PT1000, NTC_HT and NTC_LT)
J3a,	S2	Analogue input 2 (NTC, PTC or PT1000, NTC_HT and NTC_LT)
J3b	DI1	Digital input 1/Analogue input 3 (NTC, PTC or PT1000, NTC_HT and NTC_LT)
	DI2	Digital input 2
	GND	GND: reference for probes, digital inputs and analogue outputs
J4	Tx/Rx	TTL port: Tx/Rx
	Dir	TTL port: Dir
	O	TTL port: GND
	+V	TTL port: +V

Ref.		Description
J5	-	BMS serial port (RS485): Rx-/Tx-
	+	BMS serial port (RS485): Rx+/Tx+
	O	BMS serial port (RS485): GND
J7	-	VCC serial port: Rx-/Tx-
	+	VCC serial port: Rx+/Tx+
	O	VCC serial port: GND
J9	Y1	Analogue output 1
	O	GND: analogue output reference
	Y2	Analogue output 2
	O	GND: analogue output reference

Tab. 2.a

Small remote HMI

Plug-in male-female/ Screw connector



JST ZH connector

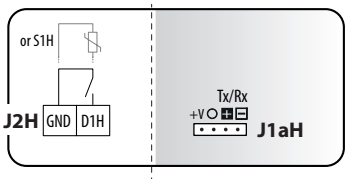


Fig. 2.j

Ref. small		Description
J1H, J1aH	-	HMI serial port: Rx-/Tx-
	+	HMI serial port: Rx+/Tx+
	O	HMI serial port: GND
	+V	HMI serial port: power supply
J2H	D1H	HMI digital input 1/HMI analogue input 1 (NTC)
	GND	GND: reference for probes, HMI digital inputs

Tab. 2.b

2.6 Probe connections

Notice:

- the probe connections relate to the default parameter configuration;
- probes S1, S2, S3, S4 can be configured as NTC, PTC, PT1000, NTC_HT and NTC_LT; probe S1H can only be configured as NTC;
- the temperature probes must all be the same type.

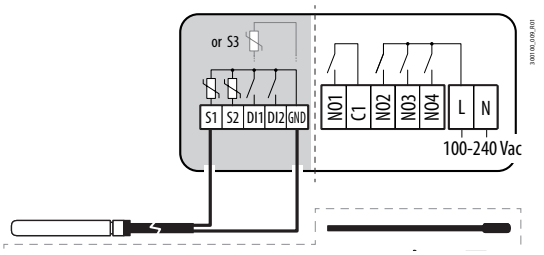


Fig. 2.k

2.7 Connection diagrams

Notice: the "Applica" app and the configuration tool (see the corresponding chapter) can be used to change the configuration of the probes without needing to rewire or change the assignment of the relays to specific functions, thus taking advantage of different capacities when needed.

2.7.1 Small model

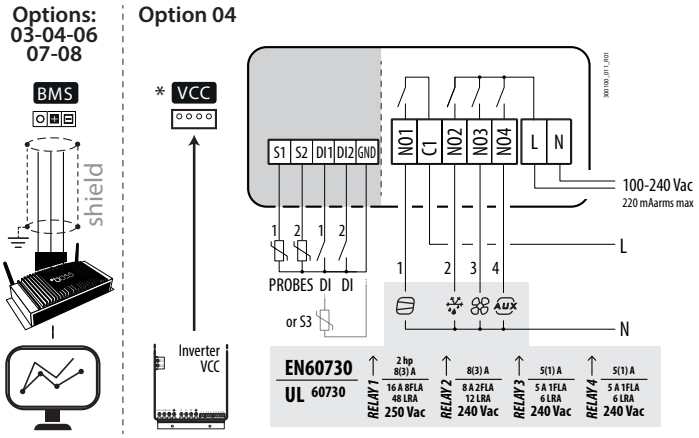


Fig. 2.l

Correspondence of terminals for serial connection (*)

IJ VCC	SECOP	EMBRACO
+V	NOT USED	NOT USED
GND	GND	O
-	O	IN
+	CIK	OUT

Tab. 2.c

2.8 Positioning inside the panel

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

2.9 Electrical installation

Caution: when laying the wiring, "physically" separate the power part from the control part. The proximity of these two sets of wires will, in most cases, cause problems of induced disturbance or, over time, malfunctions or damage to the components. The ideal solution is to house these two circuits in two separate cabinets. Sometimes this is not possible, and therefore the power part and the control part must be installed in two separate areas inside the same panel.

For the control signals, it is recommended to use shielded cables with twisted wires. If the control cables have to cross over the power cables, the intersections must be as near as possible to 90 degrees, always avoiding running the control cables parallel to the power cables.

Pay attention to the following warnings:

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

2.10 Serial port connections

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

Main device	Serial port	Lmax (m)	Wire/wire capacitance (pF/m)	Resistance on last device	Max secondary devices on bus	Data rate (bit/s)
IJ%	VCC	500	<90	-	1	600
PC (supervision)	BMS	500	<90	120 Ω	-	19200 (*)
PC (supervision)	TTL	2	<90	-	-	19200 (*)

Tab. 2.d

(*) modifiable by parameter.

Caution: connect the shield to the GND of the control, do not connect GND to earth. Connect a 120 Ω terminating resistor between the Tx/Rx+ and Tx/Rx- terminals on the last controller on the RS485 line.

2.11 Installation

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

- before performing any operations on the control board, disconnect the main power supply by turning the main switch in the electrical panel OFF;
- avoid touching the control board, as electrostatic discharges may damage the electronic components;
- the index of protection required for the application must be ensured by the manufacturer of the cabinet or by suitable assembly of the controller;
- connect any digital inputs, Lmax = 10 m;
- connect the actuators: the actuators should only be connected after having programmed the controller. Carefully evaluate the maximum ratings of the relay outputs as indicated in "Controller electrical and physical specifications";
- program the controller: See "User interface".
- for 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;
- 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.

3. CONFIGURATION TOOLS

3.1 Spark: configuration and commissioning software

Spark is configuration software for laptops that provides the following functions:
- configure access and password levels;
- change parameter sets and create custom read/write lists to upload to the device;
- add languages and parameter descriptions;
- view the trends of physical quantities in real time, with the possibility to save data in Excel format.

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

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

For the electrical connection, use the USB/RS485 converter CVSTDUMOR0 for models equipped with BMS port option.

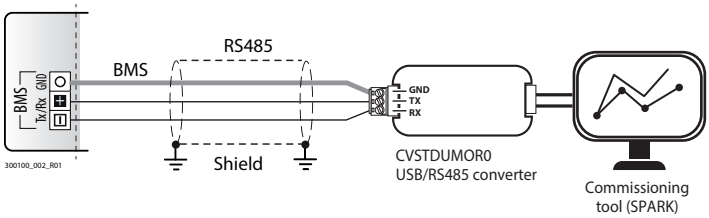


Fig. 3.a

For models without BMS port option, the USB/ID converter BXOPZIOWD000 can be used, connecting to digital input ID2 and completing the specific procedure on Spark.

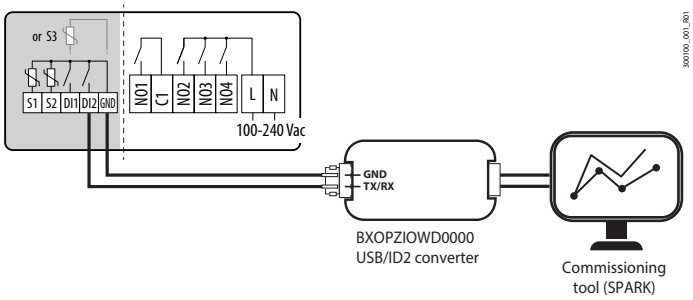


Fig. 3.b

3.2 Sparkly; command-line configuration and commissioning software

Sparkly is the command-line version of the configuration tool, and can be used for configuring and commissioning iJM. Contact Carel for support.

3.3 Replica app

The Replica app is used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication), "copying and pasting" the parameters from another iJM controller with the same hardware configuration. Supported devices: Android 5 and higher. The Replica app is available upon request, contact Carel.

3.4 Applica and Controlla apps

The Carel apps can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication) or BLE (Bluetooth Low Energy). Supported devices: Android 6, iOS 11 up to version 1.8.2017, Android 7, iOS 11 from version 1.9.2126; Bluetooth® 4.0, and higher.

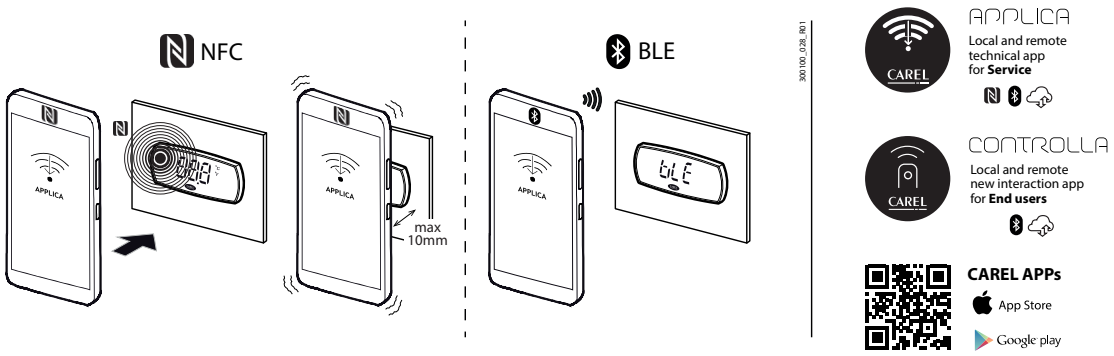


Fig. 3.c

Procedure (modify parameters):
- download the CAREL "Applica" or "Controlla" app from Apple Store or Google Play;
- (on the mobile device) enable NFC and/or Bluetooth communication and mobile data;
- open Applica (or Controlla);
- select NFC or Bluetooth® communication, depending on the iJM model;
- move the mobile device near to the user terminal, maximum distance 10 mm (for NFC only), so as to recognise the configuration;
- select the access profile and enter the required password (*);
- set the parameters as needed;
- move the mobile device near to the user terminal again to upload the configuration parameters (for NFC only).

(*) pre-assigned by the unit manufacturer to allow maintenance only by authorised service technicians, default "44". See the parameter table.

Notice:
- make sure NFC or Bluetooth have been enabled. Some smartphones may experience problems if location is not enabled.
- during Bluetooth® connection, the iJM user terminal is disabled and shows the message "bLE".

3.5 Applica Desktop

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

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

3.5.1 NFC communication for split and HMI models

All iJM models are equipped with NFC memory, which can be used to set the parameters. Due to its operating characteristics, the NFC memory is always active, even when the device is turned off. However, there are limitations for setting the parameters on the SPLIT and HMI models using NFC, as shown in the table.

Model	Programmability via NFC	
	Controller off	Controller on
Panel	YES	YES
Split	NO	YES
HMI	NO	YES

Tab. 3.a

Notice:
- when the HMI is connected to the SPLIT controller, the NFC memory on the controller is disabled.
- If replacing the HMI, when first starting the iJM split controller the working parameters are written to the HMI NFC memory.

Communication with the NFC memory can be disabled at any time by setting parameter "nFE". If nFE = 0, writes to NFC memory are ignored by the controller.

4. USER INTERFACE

4.1 Introduction

iJM is available in panel versions with front mounting and built-in display, or in the split version with rear panel mounting, with or without HMI terminal. For rear panel mounting, however, a basic user interface is provided, comprising two status LEDs, while the front panel and remote terminal feature the display and keypad with buttons for carrying out some of the controller programming operations. The user interface display features three digits with sign for below-zero temperatures and decimal point, a buzzer for signalling alarms and up to ten icons. The terminal features wireless connectivity and an NFC (Near Field Communication) or Bluetooth interface (depending on the model) for interaction with mobile devices (on which the CAREL "Applica" app has been installed, available on Google Play for the Android operating system and on Apple store for iOS devices, Bluetooth only).

Notice: for simplicity, the set of parameters accessible from the user interface is a subset of all the parameters available via the Applica app.

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

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

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	0	999	-	U	NO

Parameter /5 can be set to change the unit of measure of the values shown on the display, while parameter /6 selects whether or not to display the decimal point.

Notice: parameter /5 only affects the controller's display and not Applica and the configuration tool, which need to be set accordingly.

Code	Description	Def.	Min	Max	UOM	User
/5	Unit of measure: 0 = °C; 1 = °F	0	0	1	-	U
/6	Display decimal point (main screen only): 0 = visible; 1 = not visible	0	0	1	-	S

Parameter Hb can be set to enable or disable the buzzer (on models where featured).

Code	Description	Def.	Min	Max	UOM	User
Hb	Enable buzzer: 0 = disabled; 1 = enabled	1	0	1	-	U

Parameter /nE can be used to enable or disable navigation via the user terminal, while parameter BtE can be used to disable Bluetooth communication.
Due to its operating characteristics, the NFC memory is always active, while parameter nFE can be used to have the controller ignore writes to NFC memory.

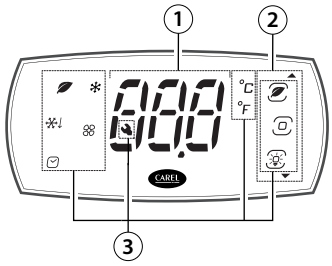
Code	Description	Def.	Min	Max	UOM	User
/nE	Navigation on the display 0 = Disabled; 1 = Enabled	0	0	1	-	M
BtE	Bluetooth communication 0 = Disabled; 1 = Enabled	1	0	1	-	M
nFE	Communication with NFC memory 0 = Disabled; 1 = Enabled	1	0	1	-	M

Parameters /Lb and /Sb can be set to change how the terminal behaves in standby; specifically, /Lb enables or disables the lighting on the status LEDs (icons), including ON/OFF, while /Sb enables or disables the lighting on the PRG button.

Code	Description	Def.	Min	Max	UOM	User
/Lb	Status LEDs on in standby (including ON/OFF): 0 = off; 1 = on.	0	0	1	-	M
/Sb	PRG button always ON in standby: 0 = off; 1 = on.	1	0	1	-	M

4.2 Models with user terminal or remote HMI

User terminal



Key:

1	Display
2	Icons/buttons
3	Icons

Fig. 4.a

Notice:

- the user terminal can only be used to set the frequent (User) and (Service) parameters and display the value of the probes connected to iJM. The Service- and Manufacturer-level parameters are set using the Applica app or the configuration software, depending on the access profile. See the parameter table and the paragraph "Parameter categories visible on the user terminal";
- Parameter /t1 is used to choose the variable to be shown on the display during normal operation:
- Parameter /5 is used to change the unit of measure .
- Parameter /d6 is used to choose the value to be shown on the display when defrosting:

Code	Description	Def.	Min	Max	UOM	User	User terminal
/5	Unit of measure: 0 = °C; 1 = °F	0	0	1	-	S	YES
/6	Display decimal point: 0 = Yes; 1 = No	0	0	1	-	S	NO
/t1	Display on user terminal: 0 = Not configured 1 = Value of S1 2 = Value of S2 3 = Value of S3 4 = Not available 5 = Value of S1H 6 to 8 = Not available 9 = Control probe 10 = Virtual probe 11 to 14 = Not available 15 = Actual control set point	9	0	15	-	S	NO
d6	Display on terminal during defrost: 0 = temperature alternating with 'dEF'; 1 = freeze display; 2 = 'dEF'	1	0	2	-	U	NO

Tab. 4.a

Keypad

Icon/button	Description	On steady		Flashing
	Eco / Up arrow	• Increase value • Scroll menu • Activate/deactivate ECO mode		-
	Program	Pressed briefly: • enter menu branch • save value and return to the parameter code	Pressed and held (3 s): • enter programming mode • return to the previous level	-
	On-Off/ Down arrow	• Unit ON • Decrease value • Scroll menu • Switch unit on/off		-
	Pull down	Active		-
	Compressor	Active		Awaiting
	Evaporator fan	Active		-
	Clock	Scheduler active		-
°C	°C	Unit of measure °C		-
°F	°F	Unit of measure °F		-
	Service Maintenance	Active alarms		-

Tab. 4.b

4.2.2 Navigation

The figure shows how to navigate between the screens on the display; specifically, the grey part shows programming mode for setting the parameters. The screens and functions of the buttons available on each screen are described in detail below.

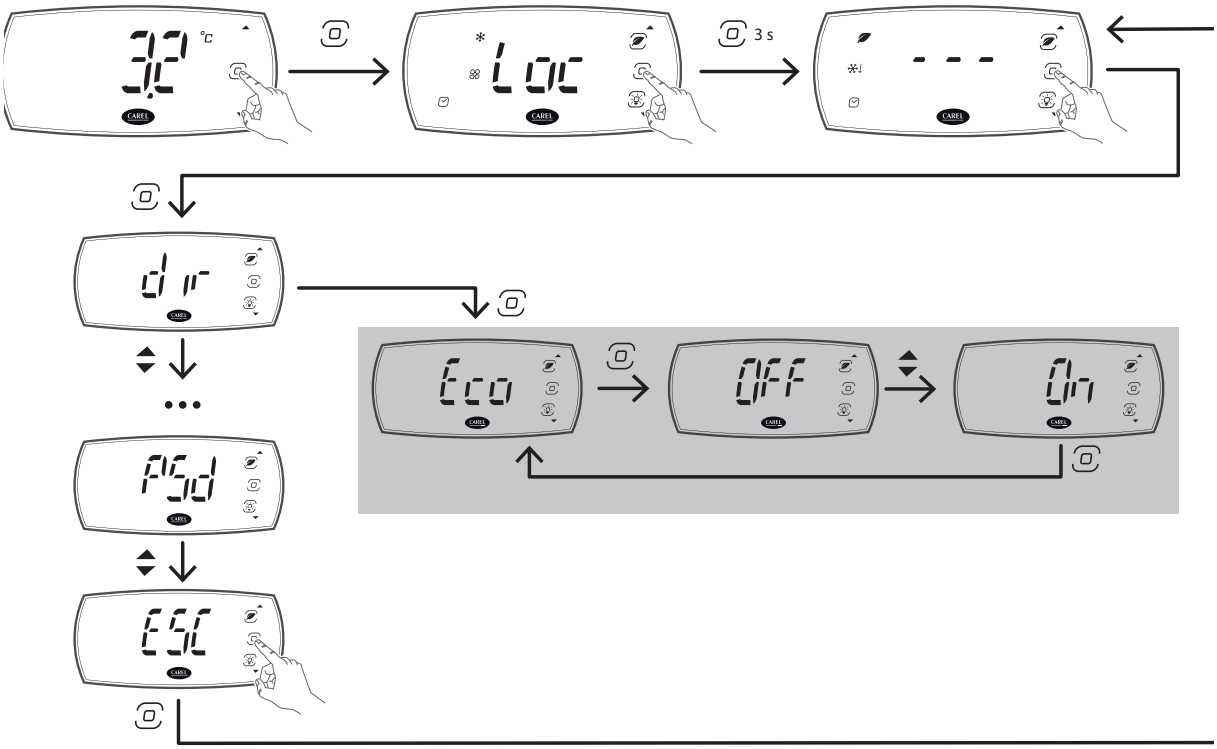


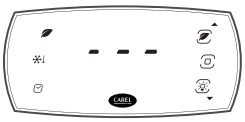
Fig. 4.b

4.2.3 Screens

The possible states of the terminal are shown in the table below.

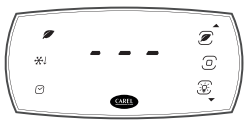
Status	Description
Standby	The display shows the main value, alternating with any alarms and signals

Status	Description
Display active loads	The terminal shows any active loads, the keypad is locked



Status	Description
Direct activation of loads and functions from the keypad	The loads can be activated or de-activated and the direct functions accessed from the keypad

Status	Description
Programming menu	Scroll the programming menu using the arrow buttons



Status	Description
Parameter programming/display values	Set the parameters using the arrow buttons or display read-only values

Status	Description
Bluetooth connection	The display is disabled, as the controller is connected to an app via Bluetooth Low Energy

Standard display

At start-up, the user terminal briefly shows the firmware version and then the standard display. 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 there is an active alarm, press any button to mute the buzzer.

Display active actuators/functions and direct activation of actuators/functions

When pressing any button, the display shows the message "Loc" and the icons (if featured) corresponding to the currently-active actuators/functions come on to indicate the status of the unit. On pressing PRG for 3 s, the display shows 3 dashes in sequence and then 3 dashes on steady and enters actuator/function direct activation mode. In this mode, when pressing the buttons associated with the actuators/functions, the display shows information on the status of the selected actuator/function (On/Off).

Notice: if no button is pressed, after 7 seconds the terminal will automatically return to the standard display.

4.2.4 Programming mode

In actuator/function direct activation mode, pressing PRG enters programming mode, where the unit's main operating parameters can be set. To access the Service parameters, go to the "PSD" menu item (see the table below) and enter the password (default 22). The user terminal only provides access to the basic configuration parameters, such as direct functions and active alarms without password protection, or, with password protection (Service).

Notice: in the default settings the user password is set to 0 and is not required when entering programming mode; if the password has been set to a value other than 0, this needs to be entered to access programming mode. Access to the Service level is also available by entering the default password 22.

Notice: for optimisations use Applica, which provides access to all of the parameters available for the corresponding profile.

Parameter categories visible on the user terminal

The menu items available and parameters visible on the user terminal are listed below. The menu branches/parameters protected by the Service password (default 22) are shown in bold italics.

dir (*) (Direct functions)	CtL (Control)	Pro (Display probes)	dEF (Defrost)	CnF (Configuration)	ALM (Alarms)	PSD	ESC
See the following table	St	/5	**dI**	Hb	AH/AHA		
	rd	**/6**	**dP1**	**H0**	AL/ALA		
	rM	**/t1**	**dt1**	**H10**	Ad		
	rt (**)	ESC	**d6**	**H11**	Add		
	IS (***)		**d8**	ESC	**rSA**		
	rSC		**ESC**		**rAL**		
	ESC				ESC		

Tab. 4.c

(*) The visibility of the direct functions can be set using the corresponding parameters, and depends on whether the functions are available on the controller.
(**) Visible if the corresponding monitoring function is enabled.
(***) Visible if there is at least one configuration loaded on the controller (see "Appendix")

Direct functions

Acr.	Description	Visibility
Auc	Activate auxiliary output	DOC > 0
BtE	Enable Bluetooth	if present
CnC	Activate continuous cycle	cc > 0
dFM	Start defrost	
Ec1	Load embedded configuration 1	if present
Ec2	Load embedded configuration 2	if present
Eco	Activate Eco mode	
Fr	Firmware version	
HL	Dim lights	/AF > 0
Lht	Activate lights	DOE > 0
OnF	Unit ON/OFF	
Pd	Activate pull down	

Acr.	Description	Visibility
rH	Maximum value of control probe	rM = 1
rL	Minimum value of control probe	rM = 1
rtL	Reset min/max control probe	rM = 1
SAh	Display alarm log	
Sc	Condenser probe	/Fo > 0
Sd	Defrost probe	/Fb > 0
Sm	Outlet probe	/Fa > 0
SPr	Product probe	/FR > 0
SrG	Control probe	
St	Set control set point	
UmA	Summer/winter management	

Tab. 4.d

Procedure

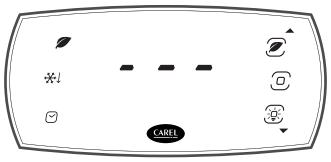
To navigate the menu tree, use the following buttons:

- UP and DOWN to navigate the menu and set the values;
- PRG to enter the menu items and save the changes made;
- Select the menu item or ESC to return to the previous branch.

Example of how to set parameter St (set point):

1. Wait for the standard display to be shown;

2. Press PRG to enter display active actuators/functions mode



3. Press PRG 3 s to access actuator/ function direct activation mode

4. Press PRG to enter programming mode; the UP and DOWN buttons will flash and the first category of parameters dir (=direct functions) will be displayed;

5. Press DOWN until reaching the parameter category Ctl (=control)

6. Press PRG to display the first menu item: St (=set point). Press PRG to display the parameter value

7. Press UP/DOWN to modify the value

8. Press PRG to save the setting and return to the menu

Caution: if the PRG button is not pressed, the new setting will not be saved.

9. Press UP/DOWN to select ESC and press PRG to return to the parameter categories;

10. Press DOWN to move to the next category and follow steps 6 to 9 to set the other parameters;

11. Once the settings have been made, to exit the categories select ESC and press PRG.

Notice: if no button is pressed, after 20 seconds the terminal will automatically return to the standard display.

Mobile device and PC

The controller can be configured via NFC (Near Field Communication) or Bluetooth from a mobile device (smartphone, tablet) using Applica, or via serial connection (laptop) using the configuration tools. The controller can be programmed according to the profile used for access to Applica or Spark, with different parameter visibility depending on the rights associated with each profile (User, Service, Manufacturer). See "Configuration tools".

Notice: when changing the parameter settings, it is recommended to power the controller off and on again to realign any timings in progress. Caution: wait at least 5 seconds are changing the parameter settings before powering the controller off, to allow the data to be correctly saved to the memory.

4.3 SPLIT models without user terminal

For Split mounting versions, a basic user interface is provided, comprising two status LEDs.

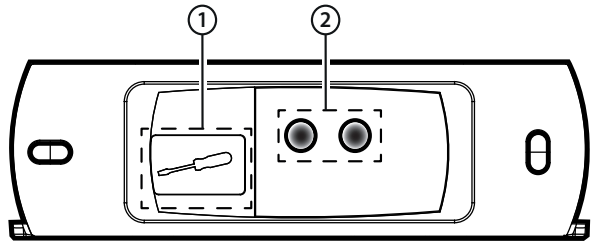


Fig. 4.c

Key:

1	HMI connector
2	Status LEDs

The meaning of the status LEDs is described in the table below.

Red LED	White LED	No. flashes	Description
○	●	-	Unit OFF
○	✳	1	Unit ON
○	✳	2	• Defrost active (dEF) • Continuous cycle active • ECO mode
✳	○	1	Probe alarms: rE, E1, E2, E3, E4, E5
✳	○	2	Temperature alarms: LO, HI, Afr, cht, CHt, dor
✳	○	3	Alarms from external contact: IA, dA
✳	○	4	Defrost alarms: Ed1, Ed2
✳	○	5	Pumpdown alarms: Pd, LP, AtS
✳	○	6	Parameter configuration alarms: EE, EF
✳	○	7	Refrigerant leak alarm: rSF
✳	○	8	Clock alarm: Etc
✳	○	9	HACCP alarms: HA, HF

Tab. 4.e

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 so-called initial configuration parameters. The configuration procedure can be run on the user terminal, a mobile device (with the Applica app), or configuration tool. 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.
- Some operations can only be performed using Applica or the configuration tools, for example, configuring the temperature probe type or setting the date/time and time bands

Commissioning parameters

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
St	Ctl	Temperature control set point	50	r1	r2	°C/°F	U
/5	Pro	Unit of measure: 0 = °C; 1 = °F	0	0	1	-	U
/6	Pro	Display decimal point (main screen only): 0 = visible; 1 = not visible	0	0	1	-	S
/t1	Pro	Display on user terminal: 0 = Not configured 1 = Value of S1 2 = Value of S2 3 = Value of S3 4 = Not available 5 = Value of S1H 6 to 8 = Not available 9 = Control probe 10 = Virtual probe 11 to 14 = Not available 15 = Actual control set point	10	0	16	-	S
d6	dEF	Display during defrost: 0 = Temperature alternating with dEF: 1 = Display locked; 2 = dEF	1	0	2	-	S
dI	dEF	Maximum interval between defrosts	8	0	240	h	S
dP1	dEF	Maximum defrost duration	45	1	240	min	S
AH	ALM	Relative high temperature alarm threshold	0	0	555/999	Δ °C/°F	S
AL	ALM	Relative low temperature alarm threshold	0	0	200/360	Δ °C/°F	S
Hb	CnF	Enable buzzer: 0 = disabled; 1 = enabled	1	0	1	-	U
/P1	-	Configure probe type S1, S2, S3: 0 = PT1000; 1 = PTC; 2 = NTC; 3 = NTC-LT; 4 = NTC-HT.	2	0	4	-	S
/P2	-	Configure probe: S3/ ID1 - 0 : S3; 1 : ID1	5	0	5	-	S

Tab. 5.a

(*): U = User; S = Service; M = Manufacturer (OEM).

5.1 Description of the initial configuration parameters

St: temperature control set point

Parameter St is used to set the temperature control set point.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
St	Ctl	Temperature control set point	50/122	r1	r2	°C/°F	U, S

rd: temperature control differential

Parameter rd is used to set the temperature control differential (see "Control").

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
rd	Ctl	Temperature control differential	2.0/3.6	0.1/0.2	99.9/179.2	Δ °C/°F	S

/5, /6, /t1: display on user terminal

Parameters /5, /6 and /t1 are used to set the display shown on the user terminal. Parameter /5 sets the unit of measure °C or °F, parameter /6 sets whether or not the decimal digit is displayed and parameter /t1 sets the value displayed, either the control probe or virtual probe reading, or one of the set points. By default, the virtual control probe value is displayed, expressed in °C with one decimal.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
/5	Pro	Unit of measure: 0 = °C; 1 = °F	0	0	1	-	U
/6	Pro	Display decimal point (main screen only): 0 = Visible; 1 = Not visible	0	0	1	-	S
/t1	Pro	Display on user terminal: 0 = Not configured 1 = Value of S1 2 = Value of S2 3 = Value of S3 4 = Not available 5 = Value of S1H 6 to 8 = Not available 9 = Control probe 10 = Virtual probe 11 to 14 = Not available 15 = Actual control set point	9	0	15	-	S

d6: display on user terminal during defrost

Parameter d6 is used to set the display shown on the user terminal when defrosting, chosen between the value selected by parameter /t1 alternating with the message 'dEF', the last value shown before defrosting, or 'dEF' alone on steady. By default, the virtual control probe value is shown, alternating with the message dEF.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
d6	dEF	Display during defrost: 0 = temperature alternating with dEF; 1 = freeze display; 2 = dEF	1	0	2	-	S

dI, dP1: defrost parameters

Parameter dI is used to set the maximum possible interval between defrosts, while parameter dP1 is used to set the maximum defrost duration. See "Functions" for more details.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
dI	dEF	Maximum interval between defrosts	8	0	240	h	S
dP1	dEF	Maximum defrost duration	45	1	240	min	S

Hb: enable buzzer

Parameter Hb is used to enable or disable the buzzer built into the controller; the buzzer is enabled by default.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
Hb	CnF	Enable buzzer: 0 = disabled; 1 = enabled	1	0	1	-	U, S

/P1, /P2: probe types

Probes S1, S2 and S3 can be configured as NTC, PTC, PT1000, NTC_HT or NTC_LT. Parameter /P1 is used to set the type of temperature probe.

Parameter /P2 is used to choose whether the multifunction input S3/ID1 is configured as a temperature probe (and in this case it will be same type set by parameter /P1) or as a digital input. Parameters /P1 and/P2 can only be set using Applica or configuration tool.

Notice: the temperature probes must all be the same type.

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
/P1	-	Configure probe type S1, S2, S3: 0 = PT1000; 1 = PTC; 2 = NTC; 3 = NTC-LT; 4 = NTC-HT.	2	0	4	-	S
/P2	-	Configuration of multifunction input S3/ ID1: 0, 1, 2, 3, 4 = S3; 5 = ID1.	5	0	5	-	S

AH/AHA, AL/ALA: high and low temperature alarm thresholds

Parameters AH and AL are used to set the thresholds relative to the set point for the high and low temperature alarms, while parameters AHA and ALA are used to set the absolute thresholds. For details on the high and low temperature alarms, see "Alarms".

Par.	Menu	Desc.	Def.	Min	Max	UOM	User
AH	ALM	Relative high temperature alarm threshold	0	0	555/999	Δ °C/°F	U
AHA	ALM	Absolute high temperature alarm threshold	537/999	-100/ -148	537/999	°C/°F	U
AL	ALM	Relative low temperature alarm threshold	0	0	200/360	Δ °C/°F	U
ALA	ALM	Absolute low temperature alarm threshold	-100/-148	-100/ -148	537/999	°C/°F	U

Notice: The visibility of parameters AH/AHA, AL/ALA depends on the setting of parameter A0 (def. 0 = relative thresholds AH, AL).

5.2 Set date/time and time bands

The smartphone's date and time can be used to set the controller's date/time, via the drop-down menu on the side in Applica, selecting "settings-->device-->set date/time".

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

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

Notice: always check the correct date and time setting for using the logs and other functions that refer to the RTC.

The correct date and time setting is required for some of the iJM controller's functions to work correctly:
- activation of the light or auxiliary output (par. H8) according to the set time bands;
- scheduled defrosts;
- temperature monitoring and recording;
- counting operating hours and activation of the maintenance alarm when a set threshold is exceeded;
- periodic and event logging.

Notice: parameter dI can be used to set cyclical defrosts every "dI" hours, even if the RTC clock is not fitted.

Caution: changing the time set on the iJM controller by more than 140 minutes will clear the stored logs.

5.3 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 time bands have been set correctly;
- the standard display has been set on the user terminal;
- the appropriate unit of measure has been set for the temperature probes (°C or °F);

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

6. FUNCTIONS

The following paragraphs describe how to implement a detailed parameter configuration.
The parameters described below can be configured via the Spark configuration software or the 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 ON/OFF

The unit can be switched on or off in different ways: user interface (button or parameter), supervisor and digital input.
Parameter On is used to switch the controller ON/OFF. If there is a digital input configured as remote ON/OFF, this has higher priority than the supervisor command or the On parameter.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIF	Assign remote ON/OFF digital input - see DIA	0	0	4	-	M	NO
On	ON/OFF command 0= OFF; 1 = ON.	1	0	1	-	U	YES

In this operating mode, the display shows the standard display set by parameter /t1, alternating with the message "OFF".

Functions enabled/disabled in OFF status

Function	Enabled	Disabled
Compressor control (off)		●
Auxiliary compressor control		●
Defrost		●
Evaporator fan control		●
Continuous cycle		●
Condensing fan control (if enabled)		●
Low temperature alarm LO		●
High temperature alarm HI		●
Immediate alarm from external contact IA		●
Delayed alarm from external contact dA		●
Defrost ended due to timeout alarm Ed1		●
Low pressure alarm from external contact LP		●
High condenser temperature warning and alarm cht, CHt	●	
Open door alarm dor		●
Buzzer (off) and alarm relay (non-alarm status)		●
Defrost according to scheduled time bands		●
Timed defrost (timer "dI" updated)		●
Defrost from digital input (if enabled)		●
Defrost from keypad and supervisor		●
Temperature monitoring	●	
Logs	●	
High and low power supply voltage alarm EHI and ELO		●
Generic alarm with high threshold GHI and GLO		●
Refrigerant leak alarm rSF	●	
Maintenance request SrC		●
Operating error UFC and VCC communication error COM		●
Parameter setting and display	●	
Auxiliary relay on/off	●	
Door switch limited to light management	●	
Control probe error alarm rE	●	
Probe error alarm E1, E2, E3	●	
Clock not updated (if featured) alarm Etc	●	
Configuration not terminated correctly alarm SF	●	
Configuration write error CE	●	
Light or aux on/off based on scheduled time bands		●
Set point changed based on scheduled time bands	●	

Tab. 6.a

Notice: in Off status, the defrost interval dI is always updated, in order to maintain the cyclical nature of this interval. If a defrost interval expires when the unit is off, the event is recorded and, when the unit is switched on, a defrost request is generated.

The transition from On to Off occurs as follows:
- the compressor protection times are observed;
- defrosting is forcibly terminated and will not resume when switching On;
- the continuous cycle is forcibly terminated and will not be resumed when switching On.

The transition from Off to On occurs as follows:
- the compressor protection times are observed;
- defrosting is not performed at start-up (if enabled), this in fact refers to power-on;
- the compressor and fan delay at start-up c0 is not set, and refers to power-on.

6.2 Inputs and outputs

On the panel models, the iJM controller has a maximum of 2 analogue inputs, 2 digital inputs and 1 multifunction input. iJM has a maximum of 4 digital outputs, and on some models a maximum of 2 analogue outputs. The HMI models have a maximum of 1 multifunction input, in addition to those available on the connected panel version. See the description of the terminals in "Description of the terminals". NTC, PT1000, PTC, NTC HT or NTC LT temperature probes can be connected to the analogue inputs; all probes must be the same type, except for any connected to the HMI terminal, which can only be NTC. The analogue outputs are PWM or 0-10 V and are independently configurable. See the parameter table.

Analogue inputs and outputs

Model	P/N	Probes					Outputs (Y1, Y2)	
		NTC (–50T90 °C)	Pt1000 (–60T120 °C)	PTC (–50T150 °C)	NTC HT (–40T150 °C)	NTC LT (–80T105 °C)	PWM	0 to 10 Vdc
SMALL, panel or split	IJ**SA*********	YES	YES	YES	YES	YES	NO	NO
	IJ**SA**06*****	YES	YES	YES	YES	YES	YES	YES
HMI	IJ*HSA*********	YES	NO	NO	NO	NO	NO	NO

Tab. 6.b

6.2.5 Probes (analogue inputs)

To assign the probe type and multifunction input type, set parameters /P1, /P2 and /P7.

	Small				HMI
Analogue input	S1	S2	S3		S1H
Parameter for type of probe	/P1		/P1	/P2	/P7
0 : PT1000	●	●	●		
1 : PTC	●	●	●		
2 : NTC	●	●	●		●
3 : NTC-LT	●	●	●		
4 : NTC-HT	●	●	●		
5 : Digital input				●	●

Tab. 6.c

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

Probe	Par.
Outlet (Sm)	/FA
Defrost (Sd)	/Fb
Intake (Sr)	/Fc

Probe	Par.
Auxiliary temperature 1 (Saux 1)	/FG
Auxiliary temperature 2 (Saux 2)	/FH
Ambient temperature	/FI

Probe	Par.
Glass temperature	/FM
Condensing temperature	/Fo
Product temperature	/FR

Tab. 6.d

Example of probe configuration.

To associate a function with a physical probe, set the value of the corresponding parameter /Fx to the value corresponding to the probe, as shown in the following table. For example, to assign the outlet temperature to probe S1, set parameter /FA to 1.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
/FA	Assign outlet temperature probe (Sm) 0 = Function disabled 1 = Probe S1 2 = Probe S2 3 = Probe S3 4 = Reserved 5 = Reserved 6 = Probe S1H 7 = Reserved	1	0	7	-	M	No

The default configuration for assigning the control probes is as follows:

- S1 = Outlet probe (Sm);

with the default settings, this probe corresponds to the virtual control probe Sv.

The default configuration also sets these three probes as standard CAREL NTC. However, other types of probes can be connected by setting parameter /P1.

Notice:

- the configuration /FA = 0 and /Fc = 0 will cause the 'rE' alarm (control probe alarm), as it means that no control probe is associated.
- For a description of the probe functions, see the following paragraphs.

Calibration (parameters /cA to /cr)

iJM offers the possibility to calibrate values read by the probes associated with the various functions set by parameters /FA to /FR. In particular, parameters /cA to /cy are used to increase or decrease the values read by the probes connected to the analogue inputs, consistently with the unit of measure.

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

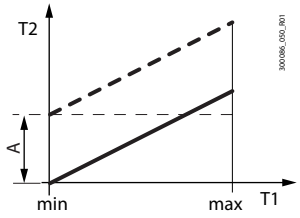


Fig. 6.a

Description

T1	Temperature read by the probe
T2	Calibrated temperature
A	Calibration offset
min, max	Field of measurement

/2: Analogue probe measurement stability and refresh display

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
/2	Analogue probe measurement stability: 0 = probe reading not delayed; … 9 = maximum probe reading delay	5	0	9	-	M	No

Parameter /2 defines the coefficient used to stabilise the temperature measurement. Low values assigned to this parameter allow a prompt response of the sensor to temperature variations; the reading however become more sensitive to disturbance.. High values slow down the response, but guarantee greater immunity to disturbance, that is, a more stable, precise and filtered reading.

6.3 Digital inputs

iJM manages up to 2 physical digital inputs and 1 multifunction input on the PANEL and SPLIT models, and up to 1 multifunction input on the HMI models. See "Installation". To associate an 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	Alarm active	Alarm not active
delayed external alarm	DIb	Alarm active	Alarm not active
enable defrost	DIc	Defrost not enabled	Defrost enabled
start defrost	DId	No effect	Start defrost
door switch with stopping control	DIE	Door open	Door closed
remote ON/OFF	DIF	OFF	ON
curtain switch/light	DIG	Day status	Night status (ECO mode)
start/stop continuous cycle	DIH	Stop continuous cycle	Start continuous cycle
change set of parameters	DIo	Set 1	Set 2
door switch without stopping control	DIP	Door open	Door closed
generic alarm function	DIS	Alarm active	Alarm not active
low pressure switch	DIt	Alarm active	Alarm not active
auxiliary input	DIU	Auxiliary input deactivated	Auxiliary input activated

Tab. 6.e

(*) Default configuration with parameters rIA, rIb, ..., rIU = 0; by setting the corresponding parameters rIA, rIb, ..., rIU = 1, the contact logic is reversed and therefore the meanings of open/closed are also reversed.

Example of digital input configuration

To associate a function with a digital input, set the value of the corresponding parameter DIx to the value corresponding to the input, as shown in the following table. For example, to assign the immediate external alarm to input ID1, set parameter DIA to 1.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIA	Immediate external alarm configuration: 0: Disabled - 1: ID1 - 2: ID2 - 3: D1H - 4: Reserved	1	0	4	-	M	No

The default configuration does not include an assigned input.

If the opposite logic to the default setting is required, or to correct a wiring error, the logic of the functions associated with the digital inputs using parameters rIA, rIb, ... rIU can be reversed.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
rIA, rIb, ...,rIU	Reverse digital input logic	0	-	0	1	S	No

Immediate external alarm (par. DIA)

Activation of the alarm causes:

- message 'IA' shown on the display and the "Service" icon flashing;
- activation of the buzzer (see par. Hb);
- activation of the alarm relay (see par. DOb);
- deactivation of the compressor output (see par. DOA).

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. The compressor is shut down immediately due to an external alarm, and consequently the compressor ON time is ignored (parameter c3).

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIA	Assign digital input for immediate external alarm. 0: Disabled - 1: ID1 - 2: ID2 - 3: D1H - 4: Reserved	0	0	4	-	M	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 set by parameter A7. If set to 0, the alarm is signal-only.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIb	Assign delayed external alarm digital input - see DIA	0	0	4	-	M	No

Enable defrost (par. DIc)

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

Notice:

- if the contact is open while a defrost is in progress, this is immediately stopped, the defrost icon flashes on the display indicating the defrost call is active (this starts again when the contact closes);
- this function may be useful to prevent defrosts on units exposed to the public during store opening hours.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIc	Assign enable defrost digital input - see DIA	0	0	4	-	M	No
dS	Defrost delay at start-up or after command from digital input	0	0	240	min	M	No

Start defrost (par. DId)

Closing the digital contact starts a defrost, if enabled.

Notice: if the defrost is disabled by another digital input configured as "enable defrost", the defrost calls are ignored.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DId	Assign start defrost digital input - see DIA	0	0	4	-	M	No
dS	Defrost delay at start-up or after command from digital input	0	0	240	min	M	No

Door switch with compressor stop (par. DIE)

Door open:

- stop compressor and evaporator fan; alternatively, the compressor can stay on by setting parameter DIP (see the description below);
- light on (see par. DOE);
- ALARM flashing;
- disable temperature alarms.

Door closed:

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

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIE	Assign digital input for door switch with solenoid/compressor and evaporator fans OFF - see DIA	0	0	4	-	M	No
DOE	Assign light digital output - see DOA	4 (small)/ 3 (large)	0	6	-	M	No
H14	Time light stays on after closing the door	0	0	240	min	U	No
Add	High temperature alarm bypass time for door open	30	1	240	min	U	No

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

Notice:

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

Door switch without compressor stop (par. DIP)

Operating mode that allows the door to be opened without stopping the compressor.
In this case, when opening the door, the evaporator fan will stop. 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	Desc.	Def.	Min	Max	UOM	User	User terminal
DIP	Assign door switch without control stop digital input - see DIA	0	0	4	-	M	No

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;
- in the transition from ON to OFF the compressor protection times are observed.

When the controller is ON again, the compressor times are observed and all of 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	Desc.	Def.	Min	Max	UOM	User	User terminal
DIF	Assign remote ON/OFF digital input - see DIA	0	0	4	-	M	No
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	Yes
c0	Delay to enable solenoid/compressor and evaporation fans at power-on	0	0	240	min	M	No

Curtain switch (par. DIG)

Digital input used to manage a curtain and switch from day to night.
During night status:
- the night set point Stn is used for control, calculated based on the set point St plus the offset defined by parameter r4 (Stn = St + r4) and r4d is used as the control differential. The control probe can also be modified according to the setting of parameter r6a (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	Desc.	Def.	Min	Max	UOM	User	User terminal
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	No
H8	Output switched with time bands: 0 = Light - 1 = AUX	0	0	1	-	S	No
r4	Automatic night set point variation	0	-50/-90	50/90	°C/°F	S	No
r4d	Night control differential	4/7.2	0.1/0.2	99.9/ 179.2	°C/°F	S	
r6a	Night control probe 0/1 = virtual probe Sv/air on probe Sr	0	0	1	-	S	No

Start/stop continuous cycle (par. DIH)

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

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIH	Assign start/stop continuous cycle digital input - see DIA	0	0	4	-	M	No

Change working set (par. Dlo)

In this case, it is possible to choose between the configuration set for parameter rS1 (digital input open) and the configuration set for parameter rS2 (digital input closed). The changeover between sets occurs during the transition in status.

Caution: when changing sets, the default parameters for the chosen configuration are loaded, and any settings made by the user to the current set of parameters may be overwritten.

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

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
Dlo	Assign working parameter set change digital input - see DIA	0	0	4	-	M	No
rS1	Configuration assigned to open digital input	1	0	IS_max	-	M	No
rS2	Configuration assigned to closed digital input	2	0	IS_max	-	M	No

Generic alarm from digital input (par. DIS)

Activation of the alarm depends on parameter GFA_E. Activation of the alarm causes:

- message GHI shown on the display and ALARM flashing;
- activation of the buzzer (see par. Hb);
- activation of the alarm relay (see par. DOb);

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIS	Assign digital input for generic alarm from digital input - see DIA	0	0	4	-	M	No
GFA_E	Generic alarm function, enable 0 = Always; 1 = Unit ON; 2 = Unit OFF; 3 = Defrost; 4 = Not used; 5 = Continuous cycle; 6 = Duty setting; 7 = Standby; 8 = Control; 9 = Door open; 10 = Active alarm.	8	0	10	-	M	No

Low pressure switch (par. Dlt)

If a low pressure switch is connected, the LP alarm is activated on opening. if pump down by pressure is enabled, the pressure switch is used to switch off the compressor and the autostart procedure.

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
Dlt	Assign low pressure switch digital input - see DIA	0	0	4	-	M	No

Digital input for activating the output configured as AUX (par. DIU)

Digital input that can be used to activate/deactivate the output configured as AUX (parameter DOC).

Code	Desc.	Def.	Min	Max	UOM	User	User terminal
DIU	Assign AUX output activation digital input - see DIA	0	0	4	-	M	No
DOC	Assign AUX auxiliary digital output - see DOA	0	0	6	-	M	No

6.4 Analogue outputs

On some models iJM has up to two 0-10 V or PWM analogue outputs (Y1, Y2), which can be configured separately by setting the corresponding parameter. The analogue outputs set as PWM can be used as a control signal to manage VCC compressors (up to a maximum of 3 in parallel for each output). The 0-10 V outputs can be used as a control signal for fans, anti-sweat heaters, LED dimmers or generic loads.

Par.	Description	Def	Min	Max	UOM	User	User terminal
/AA	Assign analogue output for modulating evaporator fans: 0 = Not configured; 1 = Analogue output 1 (Y1); 2 = Analogue output 2 (Y2)	0	0	2	-	M	NO
/Ad	Assign analogue output for modulating generic function - see /AA	0	0	2	-	M	NO
/AE	Assign analogue output for generic function - see /AA	0	0	2	-	M	NO
/AF	Assign analogue output for modulating lights - see /AA	0	0	2	-	M	NO
/AG	Assign analogue output for modulating compressor - see /AA	0	0	2	-	M	NO

6.5 Digital outputs

iJM features up to 4 digital outputs - NO1 to NO46. To associate the digital outputs with the available functions, set parameters DOA, DOb, ... DOt to the value of the physical digital output. See the parameter table.

Digital output functions

Digital output assignment for:	Par.	Default
Solenoid/compressor	DOA	Digital output 1 (NO1)
Alarm	DOb	-
Auxiliary	DOC	-
Light	DOE	Digital output 4 (NO4)
Defrost	DOG	Digital output 2 (NO2)
Evaporator fans	DOI	Digital output 3 (NO3)
Auxiliary compressor without rotation	DOk	-
Generic digital output	DOS	-
Condenser fans	DOt	-

Tab. 6.f

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

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

Solenoid/compressor (par. DOA)

This is used to assign the compressor or liquid solenoid valve output.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOA	Assogn solenoid/compressor digital output 0 = Not configured 1 = digital output 1 (NO1) 2 = digital output 2 (NO2) 3 = digital output 3 (NO3) 4 = digital output 4 (NO4) 5= Reserved; 6 = Reserved	1	0	6	-	M	NO

Alarm (par. DOb)

This is used to assign the alarm output. The relay associated with the alarm function can work as follows:

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

Notice: operation with the relay normally energised (rOA = 1) when an alarm occurs ensures maximum safety when the alarm is due to a power failure or power cable disconnection.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOb	Assign alarm digital output - see DOA	0	0	6	-	M	NO

AUX auxiliary output (par. DOc)

The relay can be activated/deactivated from the supervisor and on changeover between day/night status (linked to the curtain switch or the time band settings). Activation/deactivation of the actuator is signalled by the icon switching on/off (if present). 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).

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOC	Assign AUX auxiliary digital output - see DOA	0	0	6	-	M	NO

Light (par. DOE)

The relay can be activated/deactivated using the direct functions on the user terminal, from the supervisor and on changeover between day/night status (linked to the curtain switch or the time band settings). Activation/deactivation of the actuator is signalled by the light icon switching on/off (if present). The light output to be activated or deactivated based on the night/day time band can be selected (see parameters tS1...8, tE1...8 and H8).

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOE	Assign light digital output - see DOA	4	0	6	-	M	NO

Defrost (par. DOG)

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOG	Assign defrost digital output - see DOA	2	0	6	-	M	NO

Evaporator fans (par. DOI)

The relay is activated/deactivated based on the evaporator fan settings (see "Evaporator fans"). Activation/deactivation of the relay is signalled by the evaporator fan icon switching on/off on the display (if present).

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOI	Assign evaporator fan digital output - see DOA	3	0	6	-	M	NO

Auxiliary compressor without rotation (par. DOk)

Select the output for the auxiliary compressor without rotation (see "Control"). Setting this output enables an auxiliary compressor that is activated as a second control step, without rotation, i.e. always switching on after the main compressor. In the event of simultaneous request for both steps, the auxiliary compressor is activated after a delay time set by parameter c11, to avoid simultaneous starts.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	6	-	M	NO
c11	Second compressor start delay	4	0	250	s	M	NO

Generic function output (par. DOS)

Select the digital output for the generic function with ON/OFF output (see "Generic functions").

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOS	Assign generic function digital output- see DOA	0	0	6	-	M	NO

Evaporator fans (par. DOt)

The relay is activated/deactivated based on the condenser fan settings (see "Condenser fans").

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOt	Assign condenser fan digital output - see DOA	0	0	6	-	M	NO

6.5.1 Test output mode

The iJM controller provides the possibility to test the operation of the analogue and digital outputs, either from the configuration tool or via the Applica app, by accessing Service area > Test mode.

Par.	Description	Def	Min	Max	UOM	User	User terminal
MA1	Test mode, activate analogue output 1: 0 = Disabled; 1 = Automatic; 2 = Activated at the value of MAr1	0	0	1	-	S	NO
MA2	Test mode, activate analogue output 2 - see MA1	0	0	1	-	S	NO
MAr1	Test mode, analogue output 1 request	0	0	100	%	S	NO
MAr2	Test mode, analogue output 2 request	0	0	100	%	S	NO
Mr1	Test mode, activate relay1: 0 = Disabled; 1 = Automatic; 2 = Activated.	1	0	2	-	S	NO
Mr2	Test mode, activate relay 2 - see Mr1	1	0	2	-	S	NO
Mr3	Test mode, activate relay 3 - see Mr1	1	0	2	-	S	NO
Mr4	Test mode, activate relay 4 - see Mr1	1	0	2	-	S	NO
Mt	Manual mode duration (0 = manual mode always active)	10	0	90	min	S	NO

Parameters Mr* are used to activate the relays manually:
- Mr* = 0 the corresponding relay is deactivated;
- Mr* = 1 the corresponding relay is activated/deactivated automatically by the controller based on the associated function;
- Mr* = 2 the corresponding relay is activated.

Parameters MA* are used to activate the analogue outputs manually:
- MA* = 0 the corresponding output is deactivated;
- MA* = 1 the corresponding output is activated/deactivated automatically by the controller based on the associated function;
- MA* = 2 the corresponding output is activated at the value set by parameter MAr*.

The message 'Man' is shown on the display when at least one output is set in manual mode.
After a time set using parameter Mt, automatic operation resumes.

Caution: If Mt = 0 operation remains in manual mode until automatic operation resumes.

6.6 Control

Various modes are available for controlling the air temperature for the preservation of foodstuffs, depending on which probes are installed and their position. The following figure shows the position of the intake probe (air on) Sr and the outlet probe (air off) Sm. The virtual probe Sv is a weighted average of these two probes, based on parameter /4, according to the following formula:

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
/4	Virtual probe composition: 0 = Air off probe Sm; 100 = Air on probe Sr	0	0	100	%	S	NO

For example, if /4=50, Sv=(Sm+Sr)/2 represents an estimated value of the air temperature around the refrigerated food.

Notice: HACCP: parameter /4 can be set to change the temperature used for control and for display. This operation may be prohibited by HACCP procedures or require record keeping and authorisation.

Example: vertical showcase

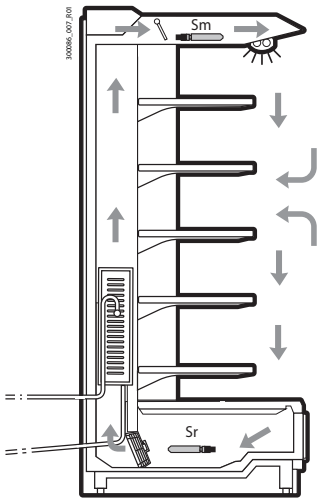


Fig. 6.b

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

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

- set point;
- differential

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
St	Temperature control set point	50/122	r1	r2	°C/°F	U	YES
rd	Temperature control differential	2/3.6	0.1/0.2	99.9/179.2	Δ °C/°F	S	YES

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

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
r1	Minimum set point	-50/-58	-99 /-146.2	r2	°C/°F	S	NO
r2	Maximum set point	50/122	r1	200/392	°C/°F	S	NO

Control offset with probe error

Par.	Description	Def	Min	Max	UOM	User	User terminal
ro	Control offset with probe error	0	0	20/36	Δ °C/°F	M	NO

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

$$ro = Sr - Sm$$

The following cases may occur:

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

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

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

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

Notice:

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

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

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

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

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

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

St*= -4-8 ·50/100=-8.

Duty setting operation

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

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

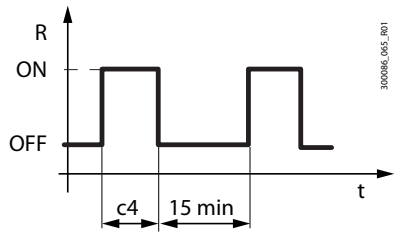


Fig. 6.c

Ref.	Description
R	Control
c4	ON time
t	Time

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

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

* Only when ro>0.

Tab. 6.g

6.7 Control modes

The iJM temperature control mode is direct with defrost control.
The figure shows the behaviour of this control mode.

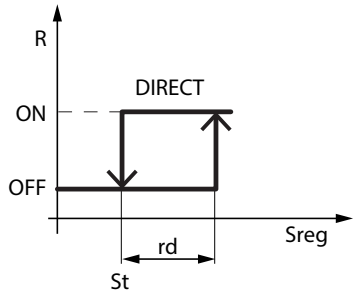


Fig. 6.d

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

ON/OFF control depends on the capacity of the produce to absorb and release heat, as well as on the evaporator cooling time. The temperature therefore fluctuates above and below the set point, and this may affect the storage temperature. Decreasing the differential to make control more precise increases the frequency of compressor on/off cycles. Precision of the measurement is in any case limited by the tolerance of both the controller and the probe.

6.7.1 Control with auxiliary compressor

In addition to the main compressor, the iJM controller can manage a second compressor output that acts as a second control step, without rotation (parameter DOk). The main compressor is always activated first.
The auxiliary compressor is activated with a delay that can be set using parameter c11, to avoid simultaneous starts.
Control with the auxiliary compressor enabled is illustrated in the figure.

Par.	Description	Def	Min	Max	UOM	User	User terminal
c11	Second compressor start delay	4	0	250	s	M	NO
DOA	Assogn solenoid/compressor digital output 0 = Not configured 1 = Digital output 1 (NO1) 2 = Digital output 2 (NO2) 3 = Digital output 3 (NO3) 4 = Digital output 4 (NO4) 5= Reserved; 6 = Reserved	1	0	6	-	M	NO
DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	6	-	M	NO

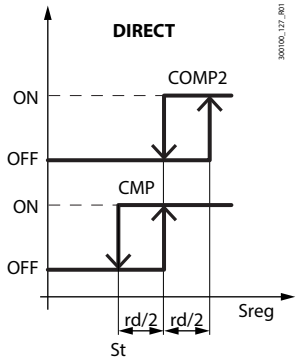


Fig. 6.e

Ref.	Description
St	Set point
rd	Differential
Sreg	Control probe
CMP	Compressor request
CMP2	Auxiliary compressor request

6.8 Night operation ("ECO" mode)

During night operation there may be a decrease in thermal load. To avoid excessively low temperatures and high energy consumption, the set point needs to be increased at night by setting parameter r4. Parameter r6a can then be used to select the virtual probe Sv or air on probe Sr as the control probe.

	Daytime operation	Night operation	
		r6a = 0	r6a = 1
Control probe	Sv	Sv	Sr
Set point	St	St + r4	St + r4

Tab. 6.h

During ECO operation, the iJM controller uses a different differential, r4d. This reduces the number of compressor starts/stops and reduces energy consumption.

Night operation can be activated by a digital input configured as a curtain switch, on the user interface, from the supervisor or time bands, with different priorities. If the digital input has been selected, this has the highest priority and the other actions are ignored, while if the digital input has not been selected, the other actions have the same priority and the last one controls the action.

To set the time bands, see "Setting the date/time and time bands".

Par.	Description	Def	Min	Max	UOM	User	User terminal
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	NO
H8	Output switched with time bands: 0 = Light; 1 = AUX.	0	0	1	-	M	NO
PEI	ECO mode available during pull down: 0 = Available; 1 = Not available.	1	0	1	-	M	NO
r4	Automatic night set point variation	0	-50/-90	50/90	°C/°F	S	NO
r6	Control probe for night operation: 0: Virtual probe (Sv) 1 = Air on temperature probe Sr	0	0	1	-	S	NO
r4d	Night control differential	4/7.2	0.1/0.2	99.9/ 179.2	°C/°F	S	NO
r9	Time for disabling ECO mode after pull down	0	0	1440	min	M	NO
tS1..8-d	Start time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	U	NO
tS1..8-hh	Start time band 1 to 8 day: hours	0	0	23	hours	U	NO
tS1..8-mm	Start time band 1 to 8 day: minutes	0	0	59	minutes	U	NO
td1..8-time	Start time band 1 to 8: type of time data for Applica	00:00:00	00:00:00	23:59:59	-	U	NO
tE1..8-d	End time band 1 to 8 day: day - see (td1...8-d)	0	0	11	day	U	NO
tE1..8-hh	End time band 1 to 8 day: hours	0	0	23	hours	U	NO
tE1..8-mm	End time band 1 to 8 day: minutes	0	0	59	minutes	U	NO

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

In a request to switch to ECO mode is received while a continuous cycle is in progress, the changeover occurs based on the value of parameter PEI. If the request to switch to night operation is received while the time r9 for disabling ECO mode has yet to elapse after pull down, the iJM controller remains in normal operation until r9 has expired, and then switches to night operation.

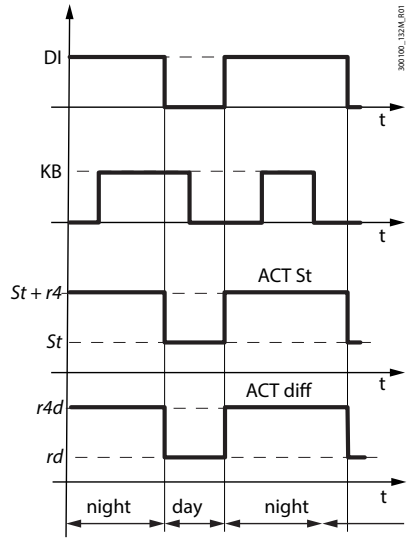


Fig. 6.f

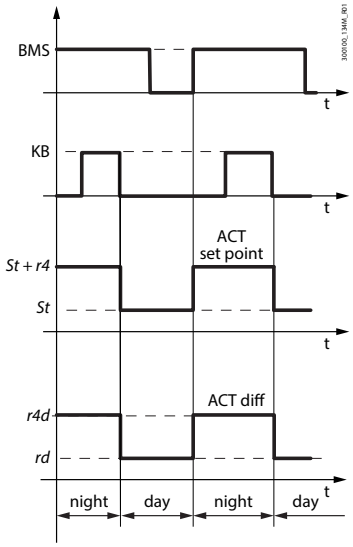


Fig. 6.g

Ref.	Description
St	Set point
r4	Night set point variation
r4d	Night differential
DI	Control from digital input
KB	Control from keypad
ACT St	Effective set point
ACT Diff	Effective differential
t	Time

Ref.	Description
St	Set point
r4	Night set point variation
r4d	Night differential
BMS	Control from supervisor
KB	Control from keypad
ACT St	Effective set point
KB	Control from keypad
t	Time

By setting the time bands and setting the light as the switched output (H8 = 0), the set point follows the day/night settings of the time bands:

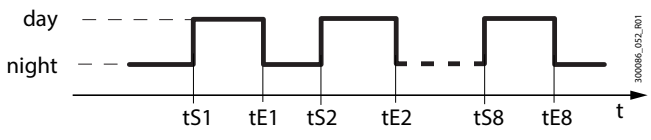


Fig. 6.h

During day status:
- Set point = St
- Control probe Sv
- Control differential rd
- Light or AUX output on, depending on parameter H8

During night status:
- Set point= St + r4
- Control probe Sv or Sr, depending on the value of r6a
- Control differential r4d
- Light or AUX output off, depending on parameter H8

6.8.1 Day/night management based on door opening

In addition to the modes described above, the iJM controller manages the changeover from normal operation to night operation taking into account the opening of the door, based on the times r60 and r70, as shown in the figure. The priority of this mode is the same as for control via user interface, supervisor or time bands, and therefore if a digital input is configured as a curtain switch, this has the highest priority and the other actions are ignored.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DIE	Assign door switch with compressor OFF digital input - see DIA	0	0	4	-	M	NO
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	NO
DIP	Assign door switch without compressor OFF digital input - see DIA	0	0	4	-	M	NO
r60	Night mode activation delay	4	0	90	h	M	NO
r70	Night mode duration	6	0	90	h	M	NO

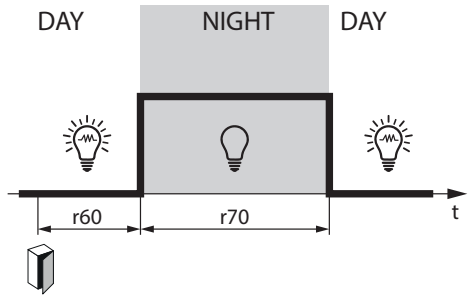


Fig. 6.i

Ref.	Description
r60	Night mode activation delay
r70	Night mode duration
t	time
DAY	Normal operation
NIGHT	Night operation

6.9 Continuous cycle

Continuous cycle is a function used to keep the refrigeration cycle active continuously for a settable duration (parameter cc), irrespective of the temperature inside the unit. This may be useful when requiring a rapid decrease in the temperature, even below the set point. The continuous cycle ends when the time set for parameter cc is reached or when the temperature falls below the set point by the value set for parameter ccE. The set point used is the effective set point

Caution: the unit of measure of parameter cc is hours.

Par.	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	NO
cc	Running time in continuous cycle, 0 = disabled	4	0	15	h	M	NO
ccE	Set point delta to end continuous cycle	0.0	0.0	9.9/17.8	Δ °C/°F	M	NO

Continuous cycle can be activated by digital input, from the supervisor, on reaching the high temperature threshold AH or from the user interface. When the continuous cycle is running:

- the icon comes on (see "User interface" for details)
- the solenoid valve/compressor output (with icon) is activated;
- the low temperature alarm with threshold AL is enabled.

The continuous cycle ends:

- on deactivation by digital input, from the supervisor or user interface;
- on reaching the time cc;
- on reaching set point-ccE;
- when there is a defrost request (if c7 = 1);
- when the iJM controller is switched to OFF status.

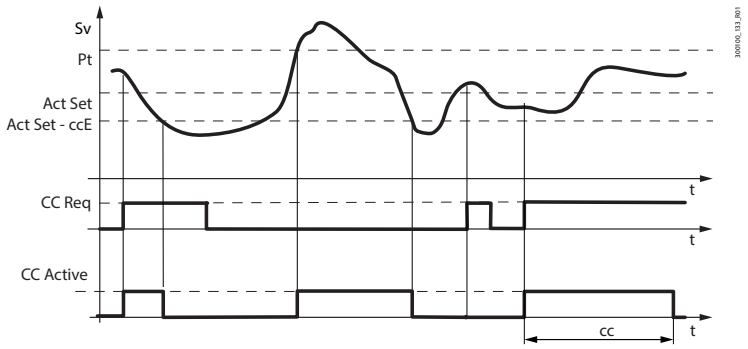


Fig. 6.j

Ref.	Description
Sv	Control probe
t	Time
Pt	Start pull down temperature
Act Set	Effective set point
ccE	Set point delta to end continuous cycle
CC Req	Request continuous cycle activation
CC Active	Continuous cycle in progress
cc	Continuous cycle duration

Notice:

1. the continuous cycle cannot be activated if:
   - the duration of the continuous cycle is set to 0 (cc = 0);
   - the temperature is below the control set point
   - the device is OFF.
2. The continuous cycle remains in standby if:
   - the compressor is waiting for the times to elapse (parameters c1, c3);
   - the immediate or delayed alarm from external digital input is active;
   - defrost, dripping, post-dripping are running;
   - the door is open. When the door is opened, the continuous cycle is interrupted. It restarts and continues for the remaining time when the door is closed.
3. The continuous cycle ends if:
   - the temperature falls below the low temperature alarm threshold AL/ALA.

Defrost priority over continuous cycle

Par.	Description	Def	Min	Max	UOM	User	User terminal
c7	Defrost priority over continuous cycle: 0 = Same priority; 1 = Defrost has priority.	0	0	1	-	M	NO

If c7 = 0, the continuous cycle has priority over defrosting: any defrost requests remain on hold while the continuous cycle is running. If c7=1, defrost requests that are activated when the continuous cycle is running terminate the latter and the defrost starts.

Notice: the manual defrosts via button or direct function can also be activated by setting c7 = 0.

Continuous cycle in ECO mode

Par.	Description	Def	Min	Max	UOM	User	User terminal
PEI	ECO mode available during pull down: 0= available, 1 = not available.	1	0	1	-	M	NO
r9	Time for disabling ECO mode after pull down	0	0	1440	min	M	NO

Parameter PEI can be used to set whether or not to switch to ECO mode while a continuous cycle is in progress. If PEI = 1, the request is ignored and the continuous cycle ends normally. If the request to switch to night operation is received while the time r9 for disabling ECO mode has yet to elapse after pull down, the iJM controller remains in normal operation until r9 has expired, and then switches to night operation.

Notice: the set point to be considered to calculate the continuous cycle end threshold is the effective set point, which depends on the status, day/night and summer/winter. Only if the curtain input is configured (parameter DIG ≠ 0) and ECO mode is disabled during pull down (PEI = 1) is the set point used to end the continuous cycle St.

6.9.1 Automatic pull down

The iJM controller an automatic temperature pull down, which automatically activates the continuous cycle when a certain temperature threshold, set using parameter Pt, is exceeded.

Par.	Description	Def	Min	Max	UOM	User	User terminal
Pt	Automatic pull down activation temperature	30/ 86	127/ 260.6	30/ 86	°C/°F	M	NO

6.10 Mitigation algorithm

The mitigation algorithm provides a suitably filtered temperature value on the display.

Par.	Description	Def	Min	Max	UOM	User	User term.
/8	Mitigation algorithm, display offset	0	-99/ - 178.2	99/178.2	Δ °C/°F	M	NO
/9	Mitigation algorithm, minimum value displayed	-3.5/ 25.7	-40/ -40	199/ 390.2	°C/°F	M	NO
/A	Mitigation algorithm, maximum value displayed	3/ 37.4	-40/ -40	199/ 390.2	°C/°F	M	NO
/b	Mitigation algorithm, alarm signal threshold	13/ 55.4	-40/ -40	199/ 390.2	°C/°F	M	NO
/E	Mitigation algorithm, filter intensity (0 = function disabled)	0	0	50	-	M	NO

The control temperature is filtered with an intensity that depends on parameter /E; low values of /E mean lower filtering intensity, while higher values mean more intense filtering and therefore the display of any temperature changes is delayed considerably.

An offset /8 is added to the filtered value and the result is compared against the thresholds /9, /A and /b:
- if the result is less than the minimum value displayed /9, the value /9 is shown on the display;
- if the result is between /9 and the maximum value displayed /A, the result itself is shown;
- if the result is between /A and the alarm signal threshold /b and is decreasing, the message "-" is shown on the display;
- if the result is between /A and the alarm signal threshold /b and is increasing, the value /A is shown on the display;
- if the result is higher than the alarm signal threshold /b and is decreasing, the message "-" is shown on the display;
- if the result is higher than the alarm signal threshold /b and is increasing, alarm "EH" is shown on the display.

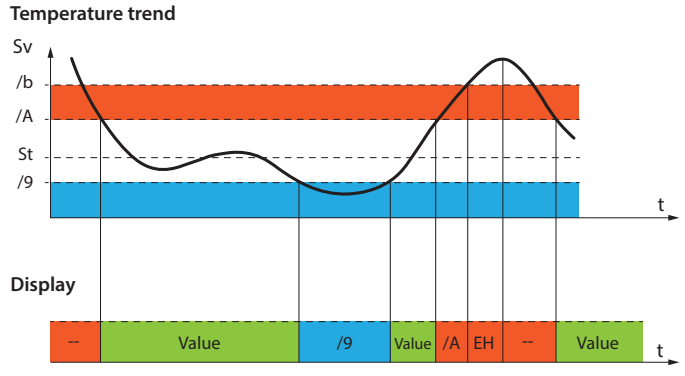


Fig. 6.k

Ref.	Description
Sv	Control probe
t	Time
/b	Alarm activation threshold
/A	Maximum value displayed
/9	Minimum value displayed
Value	Filtered value
EH	High temperature signal

Notice:
- the mitigation algorithm only affects the value shown on the display and not the value used for control.
- The mitigation algorithm has no effect on the apps, which still show the control temperature.

6.11 Summer/winter

The iJM controller provides two different set points, for summer and winter. The changeover between summer and winter can be managed on the user interface via a button, if available, direct function or app, and from the supervisor. The set point used during summer can be set using parameter St, while during winter the set point is set using parameter StU.

Par.	Description	Def	Min	Max	UOM	User	User terminal
St	Temperature control set point	50/ 122	r1	r2	°C/°F	U	YES
StU	Control set point in winter mode	5/ 41	r1	r2	°C/°F	M	NO

Notice: in ECO mode the same compensation applied to the summer set point is applied to the winter set point, therefore the night set point will be StU + r4.

6.12 Custom set points

On the iJM controller the temperature set point can be selected from preset values. This is done using the Applica app or the commissioning tools, by setting parameter St_Idx. Furthermore, on some iJM models the set points can be changed directly by pressing a button or activating a direct function on the display. The preset set point values can be changed by setting parameters Sc1, Sc2, Sc3 in the Applica app or commissioning tools.

Par.	Description	Def	Min	Max	UOM	User	User terminal
Sc1	Custom temperature set point 1	0	r1	r2	°C/°F	M	NO
Sc2	Custom temperature set point 2	0	r1	r2	°C/°F	M	NO
Sc3	Custom temperature set point 3	0	r1	r2	°C/°F	M	NO
St_Idx	Custom set point index	0	0	3	-	M	NO

6.13 Compressor

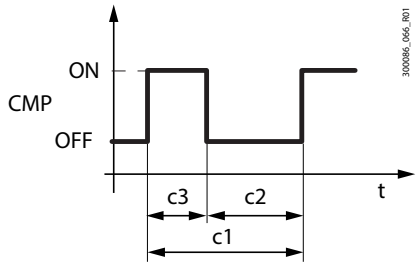
The iJM controller can manage both On/Off and modulating compressors (VCC - Variable Capacity Compressors, with serial command in the models with VCC option, or directly via the analogue output, appropriately configured). The control request is sent to the main compressor and the auxiliary compressor, as described in "Control".

6.14 Compressor protection times

The controller features the following compressor protection parameters.

Par.	Description	Def	Min	Max	UOM	User	User terminal
c0	Delay to enable solenoid/compressor and evaporation fans at power-on	0	0	240	min	M	NO
c1	Min time between consecutive compressor starts	0	0	15	min	M	NO
c2	Min compressor OFF time	0	0	15	min	M	NO
c3	Min compressor ON time	0	0	15	min	M	NO
d9	Defrost priority over compressor protection times: 0 = Compressor (the protection times are observed); 1 = Defrost (the protection times are ignored, therefore defrosting has higher priority and overrides the compressor times).	10	0	1	-	M	NO

- c0 is used to delay the start of control when the device is powered on. This function is useful for protecting the compressor and the driving relay from repeated on cycles in the event of frequent voltage drops.
- c1 sets the minimum time between two successive starts of the compressor, irrespective of the request. This parameter can be used to limit the maximum number of starts per hour;
- c2 sets the minimum compressor off time. The compressor will not be started again until the minimum time set has elapsed;
- c3 sets the minimum compressor running time. The compressor will not be started again until the minimum time set has elapsed;
- d9 disables the compressor protection times when defrosting:
  - d9 = 0: the compressor protection times are observed;
  - d9 = 1: the compressor protection times are ignored, therefore defrosting has higher priority over the compressor protection times.



Ref.	Description
CMP	Compressor
t	time

Fig. 6.l

Notice: in the event of duty setting operation (see the corresponding paragraph), if the on time c4 is less than c3, the compressor remains on for the time c3.

6.15 Variable capacity compressor (VCC)

The iJM controller calculates the optimum compressor speed based on the value read by the control probe, and sends this data to the VCC inverter, which then drives the compressor, based on the model, in one of two modes: frequency or serial protocol.

6.15.1 VCC with frequency control

For frequency-controlled inverters, some iJM models are equipped with a dedicated analogue output. The output signal is a digital square wave, with a voltage amplitude from 0 to +10 Vdc and a range defined as described below. The duty cycle is 50%.

Par.	Description	Def	Min	Max	UOM	User	User terminal
/AG	Assign analogue output for modulating compressor - see /AA	0	0	2	-	M	NO
/P5	Configuration of analogue output Y1: 7 = 0-10 V; 8 = PWM.	8	7	8	-	S	NO
/P6	Configuration of analogue output Y2: 7 = 0-10 V; 8 = PWM.	8	7	8	-	S	NO

The analogue output to be used, Y1 or Y2, is selected by parameter /AG, with the corresponding parameter /P5 or /P6 then set as a PWM output.

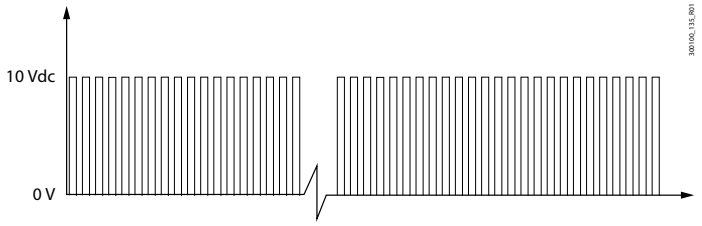


Fig. 6.m

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

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

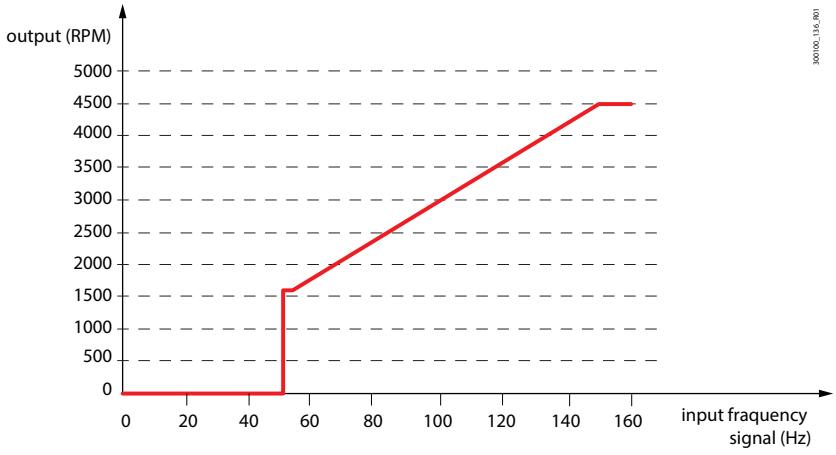


Fig. 6.n

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.

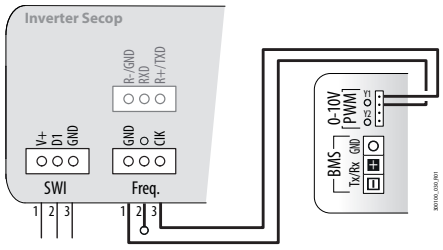


Fig. 6.o

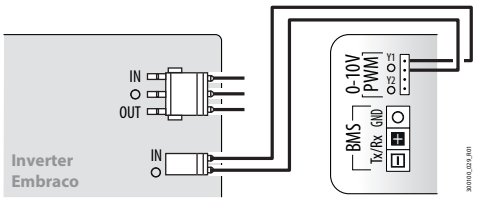


Fig. 6.p

6.15.2 VCC with serial control

For inverters with serial control, some iJM models feature a dedicated serial port. The inverter is connected directly, as shown in the following table. The following diagrams show two examples of connection to the Embraco and Secop inverters. It is recommended to refer to the inverter manufacturer's user manual for more detailed instructions and installation instructions.

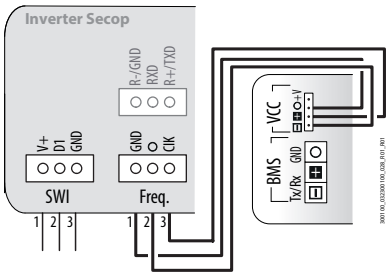


Fig. 6.q

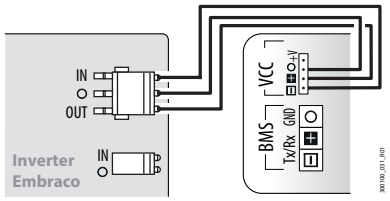


Fig. 6.r

Correspondence of terminals for serial connection

iJM VCC	Secop	Embraco
+V	Not used	Not used
O	GND	O
-	O	IN
+	CIK	OUT

Tab. 6.i

The serial communication protocol complies with the following technical specifications:

Asynchronous communication (start-stop)

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

Tab. 6.j

The compressor speed is sent to the inverter via a specific serial protocol command. The compressor speed follows the sent value, with a relationship such as the one shown in the figure:

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

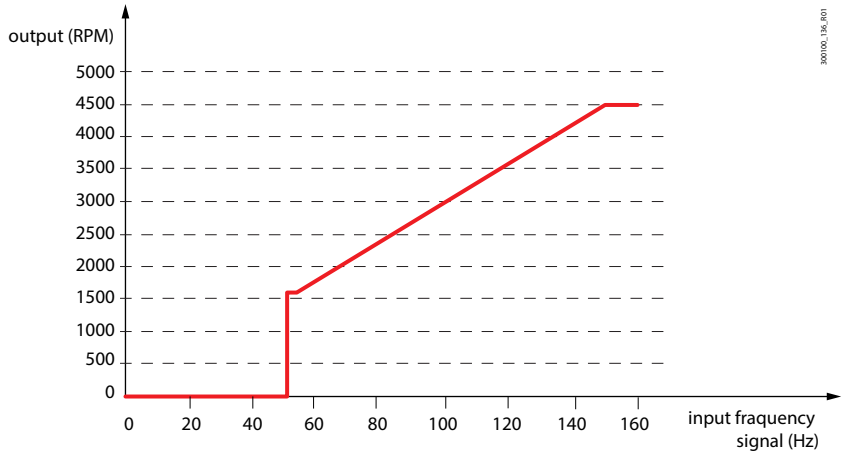


Fig. 6.s

6.15.3 VCC compressor configuration

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

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

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

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cdf	VCC compressor frequency for hot gas defrost	140	0	255	hz	(**)	NO
cMA	Maximum VCC compressor rotation frequency	150	0	250	hz	(**)	NO
cMf	Maximum VCC compressor control frequency	100	0	255	hz	(**)	NO
cMi	VCC compressor switch-off frequency	30	0	250	hz	(**)	NO
cnf	Minimum VCC compressor control frequency	52	0	255	hz	(**)	NO
cuF	Conversion factor from frequency (Hz) to compressor speed (rpm)	30	0	999	-	(**)	NO
cSc	Soft start frequency	53	0	255	hz	(**)	NO
cSt	Soft start time	5	0	999	s	(**)	NO

(**) Parameter only available via the configuration tool.

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

To adapt the cooling capacity of the VCC to the actual needs of the application, set the following parameters:
- cnf = minimum control frequency; preset value = 52 Hz (1560 rpm);
- cMf = maximum control frequency; preset value = 100 Hz (3000 rpm).

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

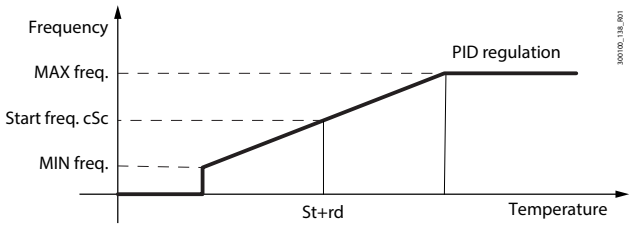
When defrosting, if set in hot gas mode, the compressor runs at a fixed frequency, defined by the following parameter:
- cdf = hot gas defrost frequency; preset value = 140 Hz (4200 rpm).

6.15.4 VCC compressor control

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

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

(**) Parameter only available via the configuration tool.



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

Fig. 6.t

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

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

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

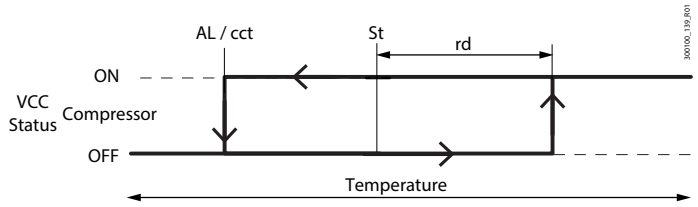


Fig. 6.u

Ref.	Description
Sv	Control probe
St	Set point
rd	Control differential
AL / cct	Reaching the low temperature threshold or switch-off time

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

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

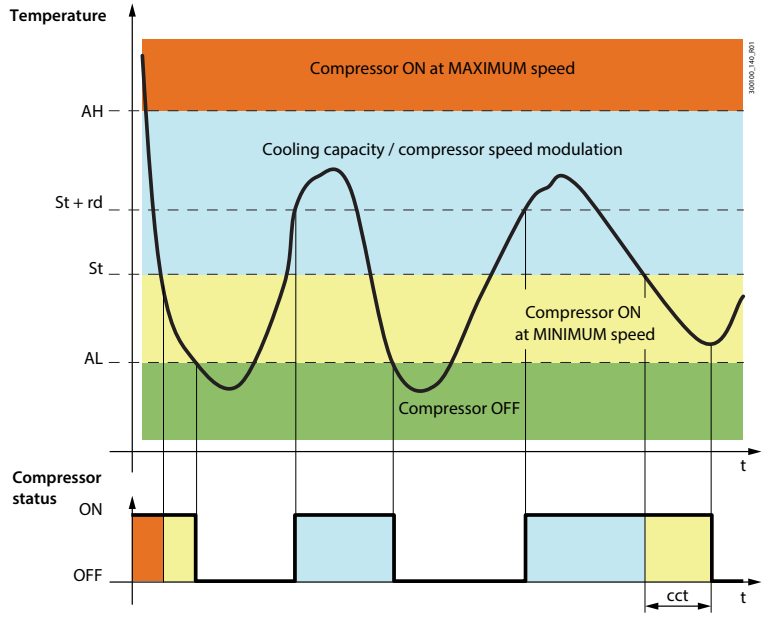


Fig. 6.v

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

6.15.5 Defrost with VCC compressor

During hot gas defrosts, the VCC compressor varies its speed based on the defrost phase: waiting, defrosting, end defrost, dripping, post-dripping. The following diagram shows how this works.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
cdf	VCC compressor frequency for hot gas defrost	140	0	255	hz	(**)	NO
cMA	Maximum VCC compressor rotation frequency	150	0	250	hz	(**)	NO
cMf	Maximum VCC compressor control frequency	100	0	255	hz	(**)	NO
cnf	Minimum VCC compressor control frequency	52	0	255	hz	(**)	NO
dd	Dripping time after defrost (0 = no dripping)	2	0	15	min	M	NO
ddF	VCC compressor frequency for dripping	140	cMi	255	hz	(**)	NO
dHG	Waiting time for compressor start to reverse cycle	0	0	300	s	M	NO
F3	Evaporator fans during defrost: 0 = on; 1 = off.	1	0	1	-	S	NO
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	M	NO

(**) Parameter only available via the configuration tool.

Without drain heater

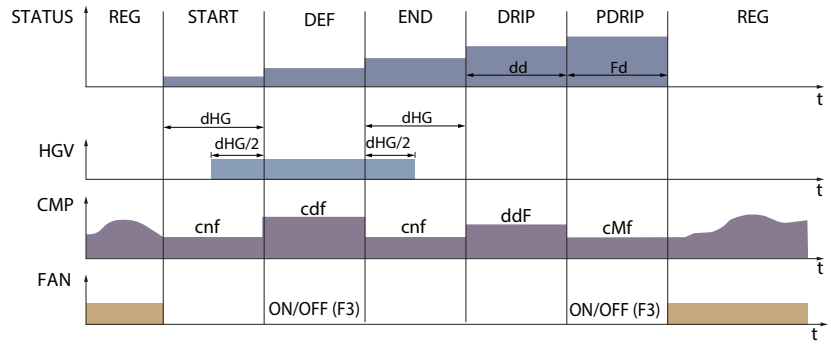


Fig. 6.w

Ref.	Description
STATUS	Defrost stages
DEF	Defrost
HG V	Hot gas valve
CMP	Compressor
FAN	Evaporator fan
t	time
REG	Control

Ref.	Description
START	Awaiting defrost
END	End defrost
DRIP	Dripping
PDRIP	Post-dripping
ON/OFF (F3)	On/Off fan based on F3
dHG	Cycle reversal waiting time

Ref.	Description
dd	Dripping time
Fd	Post dripping time
cnf	Minimum VCC control freq.
cdf	VCC freq. for hot gas defrost
ddF	Freq. VCC for dripping
cMf	Maximum VCC control freq.

When defrosting is required, the iJM controller switches the compressor to the minimum control frequency cnf and activates the hot gas valve, after the time dHG has elapsed. During the actual defrost phase, the compressor speed is equal to the value set for parameter cdf and is brought back to the value cnf when the valve is deactivated, after the time dHG has elapsed. Subsequently, for the dripping time dd where set, the compressor speed is the value set for parameter ddF and, at the end, the compressor switches to the maximum control frequency cMf for the post-dripping time Fd where set, after which it returns to normal control. During the defrost and post-dripping stages, the evaporator fans follow the settings of parameter F3.

Notice: if at the end of the defrost the temperature is higher than the alarm threshold AH or AHA, and parameter cc > 0, the compressor is activated at the maximum frequency cMA to bring the temperature down in the shortest possible time.

6.15.6 Continuous cycle with VCC compressor

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

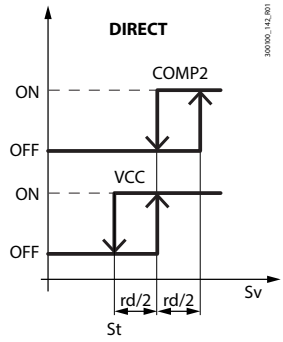
Par.	Description	Def.	Min	Max	UOM	User	User terminal
cMA	Maximum VCC compressor rotation frequency	150	0	250	hz	(**)	NO

(**) Parameter only available via the configuration tool.

6.15.7 On/Off compressor and VCC compressor

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

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



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

Fig. 6.x

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

6.16 Defrost

Introduction: The iJM controller can manage different types of defrosts, based on the setting of parameter d0. The defrost can end by temperature, in which case the defrost probe Sd must be installed, or by time. At the end of the defrost the dripping phase may begin (if dd>0), during which the compressor and the fans are off, followed by the post-dripping phase (if Fd>0), during which control resumes and the fans work based on the setting of parameter Fpd. The type of display on the user terminal during defrosting can be selected by setting parameter d6.

Code	Description	Def	Min	Max	UOM	User	User terminal
Dlc	Assign enable defrost digital input - see DIA	0	0	4	-	M	NO
Dld	Assign start defrost digital input - see DIA	0	0	4	-	M	NO
/d1	Assign end defrost probe: 1 = Air off temperature (Sm) 2 = Defrost temperature (Sd) 3 = Air on temperature (Sr) 4 = Not used 5 = Not used 6 = Not used 7 = Auxiliary probe 1 8 = Auxiliary probe 2 9 = Ambient temperature 10 = Not used 11 = Glass temperature 12 = Not used 13 = Condensing temperature 14 = Not used 15 = Frost protection temperature 16 = Product temperature	2	1	16	-	M	YES
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	-	M	NO
dt1	End defrost temperature (read by Sd)	4/ 39.2	-50/ -58	50/122	°C/°F	S	YES
dP1	Maximum defrost duration	45	1	240	min	S	YES
d6	Display on terminals during defrost: 0 = Temperature alternating with 'dEF'; 1 = Freeze display; 2 = 'dEF'.	1	0	2	-	S	YES
dd	Dripping time after defrost (fans off) 0 = No dripping	2	0	15	min	M	NO
d7	Skip defrost: 0 = Disabled - 1 = Enabled	0	0	1	-	M	NO
d8	Bypass high temperature alarm time after defrost	1	1	240	hours	S	YES
d10	Compressor ON time for running time defrost 0 = Function disabled	0	0	240	min	M	NO
d11	Defrost temperature threshold in running time mode	-50 /-58	-50 /-58	50 / 122	°C/°F	M	NO
d15	Start defrost delay	0	0	240	min	M	NO
dn	Nominal defrost duration for skip defrost	75	0	100	%	M	NO
F2	Evaporator fans with compressor off: 0 = See F0; 1 = Always off with compressor off; 2 = On for anti-stratification; 3 = Reserved	1	0	3	-	M	YES
F3	Evaporator fans during defrost: 0 = on - 1 = off	1	0	1	-	M	NO
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	M	NO
Fpd	Evaporator fans during post-dripping 0/1 = On/Off	1	0	1	-	M	NO
A3	Defrost terminated after maximum time signal: 0 = Disabled 1 = Enabled	0	0	0	-	S	YES

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

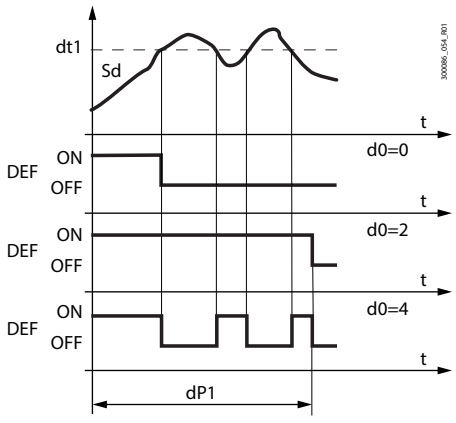


Fig. 6.y

Ref.	Description
t	time
dt1	End defrost temperature
dP1	Maximum defrost duration
Sd	Defrost probe
DEF	Defrost
d0	Type of defrost

The heater defrost by time with temperature control (d0=4) activates the defrost output only if the evaporator temperature (Sd) is less than the value of parameter dt1, and ends after the time defined by dP1. This function is useful for energy saving and to prevent excessive temperatures on the evaporator. Parameters td1 to td8 can be used to set up to 8 defrost events based on the controller's clock (RTC), on models where featured. To set parameters td1 to td8, use the supervisor, the configuration tool or the Applica app. See "Configuration tools".

Code	Description	Def.	Min	Max	UOM	User	User term.
td1..8-d	Defrost 1 to 8 - day 0 = event disabled 1 to 7 = Monday to Sunday 8 = Monday to Friday 9 = from Monday to Saturday 10 = Saturday & Sunday 11 = every day	0	0	11	-	S	NO
td1..8-hh	Defrost 1 to 8 - hours	0	0	23	hours	S	NO
td1..8-mm	Defrost 1 to 8 - minutes	0	0	59	min	S	NO
td1..8-time	Defrost 1 to 8 - data type for Applica	00:00:00	00:00:00	23:59:59	-	S	NO

Input and output settings

Code	Description	Def.	Min	Max	UOM	User	User term.
/Fb	Assign defrost temperature probe (Sd) - see /FA	0	0	7	-	M	NO
/cb	Defrost temperature probe (Sd) calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
DOG	Assign defrost digital output - see DOA	2	0	6	-	M	NO
rOG	Defrost digital output logic - see rOA	0	0	1	-	S	NO

Start defrost

The events that activate a defrost are shown in the table.

Event	Defrosting
Interval between defrosts expired	Dependent on enabling (dI > 0)
Time band	Dependent on enabling (time bands set) and presence of the RTC
Compressor running time	Dependent on enabling (d10 > 0)
Start-up	Dependent on enabling (Sd < d11)
At each compressor start	Dependent on enabling (Sd < d11)
Digital input	Dependent on enabling (DId > 0)
Supervision	Always
Keypad/Direct function	Dependent on the presence of the button/enabling of the direct function
App/Commissioning tool	Always
Opening the door	Dependent on enabling (DcL > 0)

Tab. 6.k

Start defrost

The iJM controller can manage the following types of defrosts, based on the setting of parameter d0:

1. heater (placed near the evaporator) by temperature;
2. hot gas by temperature;
3. heater by time;
4. hot gas by time;
5. heater by time with temperature control.

The details of each type of defrost are illustrated in the following paragraphs.
If defrost by temperature is selected, it is performed only if the value read by the evaporation temperature probe Sd is lower than the defrost end value (dt1) or has an error.

For heater defrosts:

- first the time d15 elapses;
- the compressor stops (performing pump down, if enabled);
- the defrost relay is activated to switch on the heater.

During hot gas defrost:

- first the time d15 elapses;
- then the compressor stops;
- the time dHG/2 elapses;
- the defrost relay is activated to open the hot gas valve.
- the time dHG/2 elapses;
- the compressor starts;

Notice:

- if parameter dHG has a value other than zero, pump down is not performed during hot gas defrost.
- if the control temperature is lower than the low temperature alarm threshold (parameter AL or ALA), the compressor cannot start and therefore the hot gas defrost will not be performed. If the temperature falls below the alarm threshold during defrosting, the compressor will stop immediately.

End defrost

The defrost ends by temperature when the value set by parameter dt1 is reached, or by time, when the value dP1 is reached, based on the setting of parameter d0.

If defrost by temperature is selected, the defrost probe Sd needs to be installed; the defrost ends when the probe Sd measures a value greater than the setting of dt1 or by timeout after the maximum time dP1 has elapsed; in this case, based on the setting of parameter A3, Ed1 is displayed. If set to end by time, the defrost ends after the time dP1.
The heater defrost by time with temperature control (d0=4) activates the defrost output only if the evaporator temperature Sd is less than the value of parameter dt1, and ends after the time defined by dP1. This function is useful for energy saving and to avoid excessively heating the evaporator.

For hot gas defrost, when the defrost ends:
- the compressor stops;
- the time dHG/2 elapses;
- the main and secondary evaporator defrost relays are deactivated to deactivate the hot gas valve.
- the time dHG/2 elapses;
- the compressor starts;

At the end of the defrost, the controller can activate the dripping phase (if dd>0), during which the compressor and the fans are off, followed by the post-dripping phase (if Fd>0), during which control resumes with the fans off. If the defrost is terminated in advance (e.g. stopped from keypad/BMS), dripping and post-dripping are not performed. The user terminal display during defrosting can be selected by setting parameter d6.

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

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

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

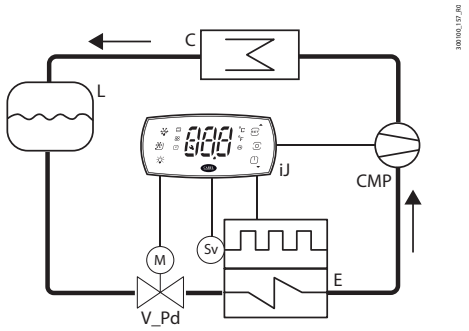


Fig. 6.z

Ref.	Description
t	Time
FAN	Fan
DEF	Defrost
DRIP	Dripping
CMP	Compressor
PDRIP	Post-dripping
REG	Control

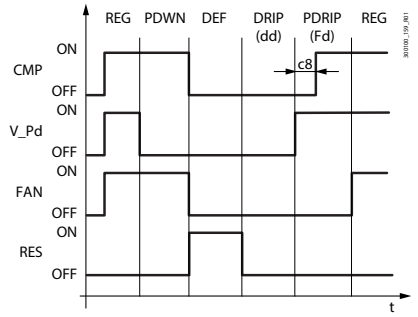


Fig. 6.aa

Ref.	Description
RES	Defrost heater
V_Pd	Pump down valve
C	Condenser
E	Evaporator
L	Liquid receiver
PDWN	Pump down

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

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

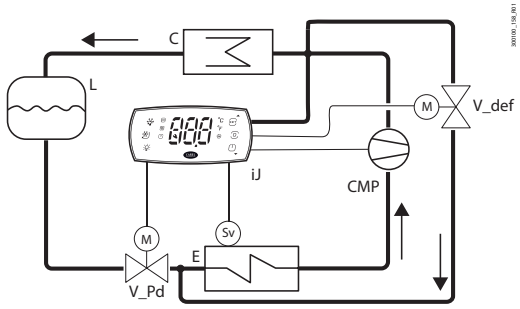


Fig. 6.ab

Ref.	Description
t	Time
FAN	Fan
DEF	Defrost
DRIP	Dripping
CMP	Compressor
PDRIP	Post-dripping
PDWN	Pump down

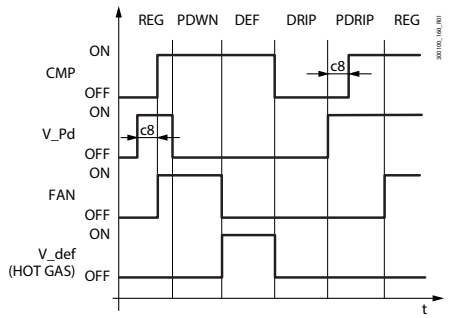


Fig. 6.ac

Ref.	Description
REG	Control
HOT GAS	Hot gas valve
V_Pd	Pump down valve
C	Condenser
E	Evaporator
L	Liquid receiver

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

During the dripping phase the fan is always off, while during the post-dripping phase operation depends on the setting of parameter Fpd.

Code	Description	Def	Min	Max	UOM	User	User term.
dd	Dripping time after defrost (fans off) 0 = No dripping	2	0	15	min	M	NO
F2	Evaporator fans with compressor off: 0 = See F0; 1 = Always off with compressor off; 2 = On for anti-stratification; 3 = Reserved	1	0	3	-	M	NO
F3	Evaporator fans during defrost: 0 = on - 1 = off	1	0	1	-	M	NO
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	M	NO

6.16.3 Advanced defrosting features

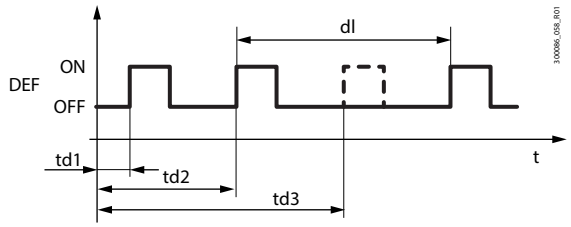
Maximum interval between consecutive defrosts (par. dI)

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

Tab. 6.l

Parameter dI is a safety parameter used to perform cyclical defrosts every "dI" hours, event without the real time clock (RTC). At the start of each defrost, irrespective of the duration, an interval starts being counted. If this interval exceeds dI without a defrost being performed, one is started automatically. The count is always active even if the controller is OFF.

Example: If the defrost programmed by time td3 is not carried out due to a fault in the RTC, a new defrost starts after the safety time dI.



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

Fig. 6.ad

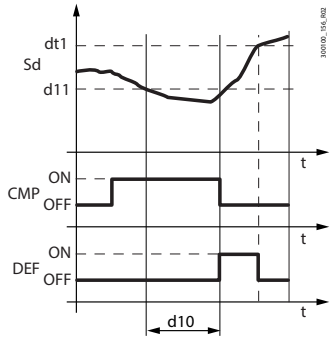
Notice:
- if the interval dI expires when the controller is OFF, a defrost will be performed when it is switched ON;
- to ensure correct defrosting, the interval between defrosts must be greater than the maximum defrost duration, increased by the dripping and post-dripping times.

Notice: to avoid unwanted defrosts controlled by the timer, set parameter dI=0 (defrosts from keypad, RTC, compressor running time or digital input only).

Running time defrost (par. d10, d11)

Running time is a special function that determines when the refrigeration unit needs defrosting. Specifically, it is assumed that if the compressor remains on for a certain period (d10) and the evaporator temperature measured by probe Sd remains constantly below the threshold (d11), there is possibly ice on the evaporator and therefore defrosting is required. The time is reset if the temperature returns above the threshold.

Code	Description	Def	Min	Max	UOM	User	User terminal
dt1	End defrost temperature (read by Sd)	4/ 39.2	-50 /-58	50/122	°C/°F	S	YES
d10	Compressor ON time for running time defrost 0 = Function disabled	0	0	240	min	M	NO
d11	Defrost temperature threshold in running time mode	-50 /-58	-50 /-58	50/122	°C/°F	M	NO



Ref.	Description
Sd	Defrost probe
t	time
DEF	Defrost
CMP	Compressor

Fig. 6.ae

Defrost at each compressor start

With defrosts controlled by temperature, if the evaporator temperature is lower than d11 when there is a cooling request, preventive defrosting is required before starting the compressor. This avoids starting the compressor and then stopping immediately afterwards, thus reducing the number of compressor starts.

Notice: this condition is not verified the first time the compressor is started after switching the unit on.

Defrost after opening the door

Opening the door allows humid air into the showcase, which can condense and freeze on the evaporator. Consequently, the controller records the number of door openings that occur when the evaporation temperature is below zero. When the door is opened a number of times equal to the setting of DoL, a defrost is activated. The controller checks the defrost duration and adjusts the number of door openings that must be reached before the next defrost.

Par.	Description	Def	Min	Max	UOM	User	User terminal
dCH	Defrost after opening the door: maximum number of openings	50	dcL	99	-	M	NO
dcL	Defrost after opening the door: minimum number of openings	0	0	dCH	-	M	NO
dPH	Defrost after opening the door: maximum defrost duration	15	dPL	dP1	min	M	NO
dPL	Defrost after opening the door: minimum defrost duration	5	0	dPH	min	M	NO

If the defrost duration:
- is less than dPL, the number of openings is increased by 10;
- is more than dPH, the number of openings is decreased by 5;
- is between dPL and dPH, the number of openings remains unchanged.

In any case, the number of door openings always remains between the minimum and maximum limits dcL and dcH.

Notice: the door opening counter is reset every time a defrost is performed.

Skip defrost (par. d7, dn)

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

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

The threshold dn1 is calculated based on the parameter settings:

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

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

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

Notice:
- if at any time the defrost ends after dn1, the next defrost is performed and the counter is reset.
- the algorithm only applies to defrosts scheduled by time bands or cyclical defrosts (par. DI); manual defrosts or those started by the supervisor are always performed and do not affect the counter.

6.16.4 Other defrost parameters

End defrost signal by timeout (par. A3)

Code	Description	Def	Min	Max	UOM	User	User terminal
A3	End defrost signal by timeout: 0 = disabled; 1 = enabled	0	0	1	-	M	NO

Defrost at power on (par. d4)

Code	Description	Def	Min	Max	UOM	User	User terminal
d4	Enable defrost at power on: 0 = Disabled 1 = Enabled	0	0	1	-	M	NO

Notice: the defrost call on power-up has priority over the control request and activation of the continuous cycle.

Defrost delay at power on (parameter d5)

Code	Description	Def	Min	Max	UOM	User	User terminal
d5	Defrost delay at start-up or after command from digital input	0	0	240	min	M	NO

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

Dripping time after defrost (par. dd)

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

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

Defrost priority over compressor protection (par. d9)

Code	Description	Def	Min	Max	UOM	User	User terminal
d9	Defrost priority over compressor protection times: 0 = The compressor protection times are observed; 1 = The compressor protection times are ignored, therefore defrosting starts without waiting for the compressor protection times to elapse	0	0	1	-	M	NO

Parameter d9 is used to set the priority of defrosts over the compressor times c1, c2, c3 when there is a defrost request.

Defrost priority over continuous cycle (par. c7)

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	NO

Parameter c7 is used to set the priority of defrosting over the continuous cycle:
- if c7 = 0, the continuous cycle has priority over the defrost requests;
- if c7 = 1, if the continuous cycle is in progress and there is a defrost request, the continuous cycle ends and the defrost starts.

Defrost interval unit of measure (par. dC)

Code	Description	Def	Min	Max	UOM	User	User terminal
dC	Time base for defrosts 0: dI in hours, dP1 in minutes; 1: dI in minutes, dP1 in seconds	0	0	1	-	S	NO

Parameter dC is used to change the unit of measure (hours/minutes or minutes/seconds) used to count the times for parameters dI (defrost interval, hours or minutes) and dP1 (defrost duration) . This feature is particularly useful when configuring the defrosts.

6.17 Evaporator fans

The evaporator fans can be fixed speed (On/Off) or variable speed (modulating 0-10 V).

Notice: variable speed fans are only available on models with analogue outputs Y1 and Y2, PWM or 0-10 V, see "Introduction".

To assign the On/Off or modulating output, use the parameters shown in the table.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOI	Assign evaporator fan digital output - see DOA	3 (small)/ 4 (large)	0	6	-	M	NO
rOI	Evaporator fan digital output logic - see rOA	0	0	1	-	S	NO
/AA	Assign analogue output for modulating evaporator fan 0 = Not configured; 1 = Analogue output 1 (Y1) 2 = Analogue output 2 (Y2)	0	0	2	-	M	NO
/P5	Configuration of analogue output Y1: 7 = 0-10V ; 8 = PWM	8	7	8	-	S	NO
/P6	Configuration of analogue output Y2: 7 = 0-10V ; 8 = PWM	8	7	8	-	S	NO

Notice: if an analogue output is assigned to the variable-speed evaporator fan function and the evaporator fan is also assigned to a relay output, both outputs will be active at the same time; if the speed is greater than 0, the relay will remain active (closed):

- if speed (Y1) > 0 → "FAN" relay ON (NO* closed)
- if speed (Y1) = 0 → "FAN" relay OFF (NO* open)

6.17.1 Fixed-speed evaporator fans

To activate the algorithm, simply assign a relay output to the evaporator fan function (on some models this is already assigned by default, see the product label). In addition, the defrost probe needs to be configured if this is required for control. See "Inputs and outputs".

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
F0	Evaporator fan management: 0 = Always on; 1 = Activation based on Sd – Sv; 2 = Activation based on Sd; 3 = Activation based on Sv.	0	0	3	-	S	NO
F1	Evaporator fan activation threshold (only if F0 = 1, 2, 3)	5/ 41	-50/-58	200/ 392	°C/°F	S	NO
F2	Evaporator fans with compressor off: 0 = See F0; 1 = Always off with compressor off; 2 = On for anti-stratification; 3 = Reserved	1	0	3	-	S	NO
Frd	Evaporator fan activation differential (including variable speed)	2/ 3.6	0.1/0.2	20/ 36	°C/°F	S	YES

iJM manages the evaporator fans as follows:

- F0 = 0 always on;
- F0 = 1 on/off based on difference between probes Sd and Sv;
- F0 = 2 on/off based on defrost probe Sd;
- F0 = 3 on/off based control probe Sv.

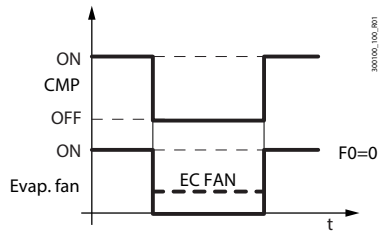
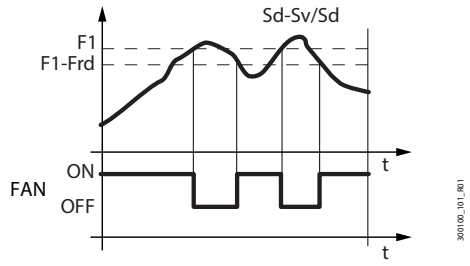


Fig. 6.af

If parameter F0=0, the evaporator fans are on when the compressor is on (based on the setting of parameter F2), regardless of the defrost or control temperature.

If parameter F0=1 or 2, the evaporator fans are on/off based on the difference between the defrost and control probe temperatures, or based on the defrost probe reading. The fans switch on when the control variable falls below the threshold F1 value minus the control differential Frd, and switch off when the control variable rises above the threshold F1.

If parameter F0=3, the evaporator fans are on/off based on the control probe reading. The fans switch on when the control variable falls below the threshold St minus the control differential rd, and switch off when the control variable rises above the threshold St.



Ref.	Description
Sd	Defrost probe
Sv	Control probe
F1	Fan activation threshold (St if F0=3)
Frd	Differential (rd if F0=3)
t	time
FAN	Evaporator fans

Fig. 6.ag

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

The evaporator fans can be forced on during control (parameter F2) and during defrosts (parameter F3).

Evaporator fans during defrost

When defrosting (parameter F3), the fans can be forced off. During the dripping time (parameter dd > 0) the fans are always off, while during the post-dripping time (parameter Fd > 0), the status of the fans can be defined by setting 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.

Par.	Description	Def	Min	Max	UOM	User	User terminal
dd	Dripping time after defrost (0 = no dripping)	2	0	15	min	M	NO
F3	Evaporator fans during defrost: 0 = On; 1 = Off.	1	0	1	-	S	NO
Fd	Post-dripping time after defrosting (fans off with control active)	2	0	15	min	M	NO
Fpd	Evaporator fans during post-dripping: 0 = On; 1 = Off.	1	0	1	-	M	NO

Anti-stratification

Set parameter F2 = 2 to prevent stratification of the air inside the showcase when the compressor is off. The fan performs a series of ON and OFF cycles with settable times that differ depending on the time (day or night). When the compressor is switched off, the fan remains ON.

Par.	Description	Def	Min	Max	UOM	User	User terminal
F2	Evaporator fans with compressor off: 0 = See F0; 1 = Always off with compressor off; 2 = On for anti-stratification; 3 = Reserved	1	0	3	-	S	NO
Fd0	Evaporator fan ON time for anti-stratification during the day	5	1	100	min	M	NO
FdF	Evaporator fan OFF time for anti-stratification during the day (0 = always On during the day)	10	0	100	min	M	NO
Fn0	Evaporator fan ON time for anti-stratification at night	5	1	100	min	M	NO
FnF	Evaporator fan OFF time for anti-stratification at night (0 = always On at night)	20	0	100	min	M	NO

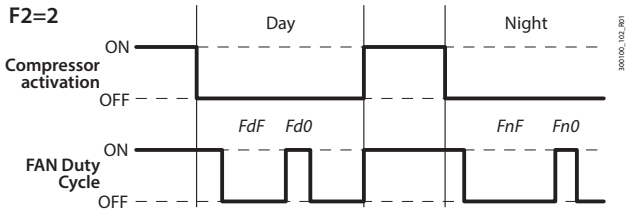


Fig. 6.ah

6.17.2 Variable-speed evaporator fans (EC fans)

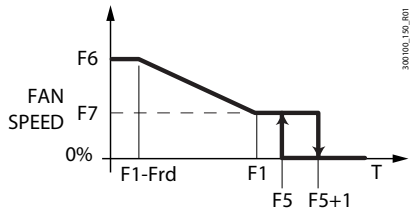
Variable-speed fans may be useful for optimising energy consumption. In this case, the fans are powered by the mains, while the control signal may come via output Y1 or Y2 on the iJM controller, set as 0-10 Vdc.

Notice: variable speed fans are only available on models with analogue outputs Y1 and Y2, PWM or 0-10 V, see "Introduction".

To activate the algorithm, simply assign an analogue output to the variable-speed evaporator fan function by setting the type of output accordingly. In addition, the evaporation temperature probe needs to be configured if this is required for control. See "Inputs and outputs". The maximum and minimum fan speed can be set using parameters F6 and F7 (as a percentage of the range 0-10 V).
The fan speed varies proportionally across the range of modulation.

For example, considering the default values of the parameters, if F0 = 2 and Sd = F1-Frd/2 = 6°C –› output Y1 corresponds to the percentage (F6+F7)/2 = 50%. If using the fan speed controller, F5 represents the temperature below which the fans are activated, with a fixed deactivation hysteresis of 1°C.

Par.	Description	Def	Min	Max	UOM	User	User terminal
F0	Evaporator fan management: 0 = Always on; 1 = Activation based on Sd – Sv; 2 = Activation based on Sd; 3 = Activation based on Sv	0	0	3	-	S	NO
F1	Evaporator fan activation threshold (only if F0=1 or 2)	5/ 41	-50/-58	200/ 392	°C/°F	S	NO
F5	Evaporator fan cut-off temperature (hysteresis 1 °C)	50	F1	50	°C/°F	M	NO
F6	Maximum evaporator fan speed	100	F7	100	%	M	NO
F7	Minimum evaporator fan speed	0	0	F6	%	M	NO
F8	Evaporator fan start-up time (0 = function disabled)	0	0	240	s	M	NO
F10	Evaporator fan forcing time at maximum speed (0 = function disabled)	0	0	240	min	M	NO
Frd	Evaporator fan activation differential (including variable speed)	2/ 3.6	0.1/0.2	20/36	°C/°F	S	NO

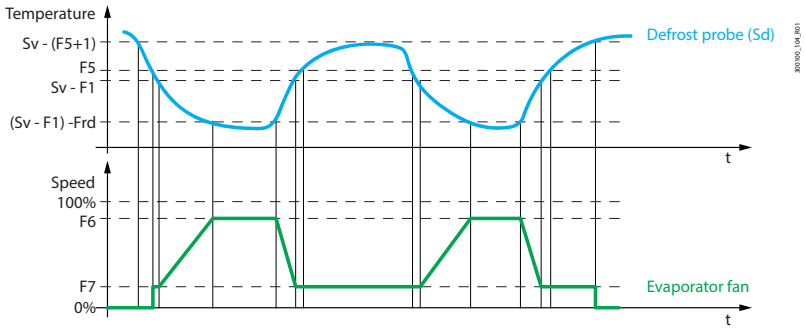


Ref.	Description
T	temperature
F1	Fan activation threshold
Frd	Differential
F5	Fan cut-off temperature
F6	Maximum speed
F7	Minimum speed

Fig. 6.ai

If parameter F0=0, the evaporator fans are on when the compressor is on (based on the setting of parameter F2), regardless of the defrost or control temperature.

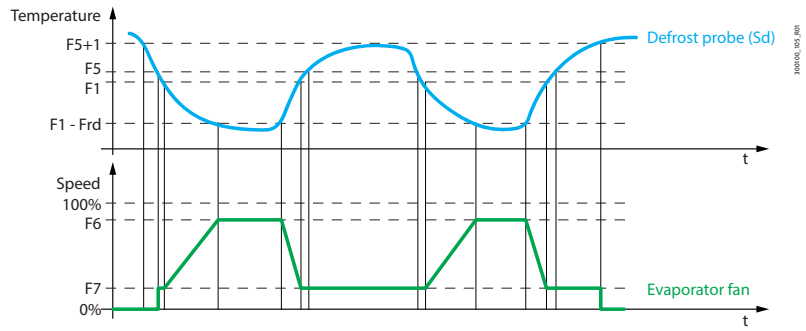
If parameter F0 = 1, the evaporator fan speed is modulated based on the evaporator temperature and the control temperature, with the speed increasing the further the temperature is below Sv-F1.



Ref.	Description
Sv	Control probe
F1	Fan activation threshold
Frd	Differential
F5	Fan cut-off temperature
F6	Maximum evaporator fan speed
F7	Minimum evaporator fan speed
t	time
Speed	Evaporator fan speed

Fig. 6.aj

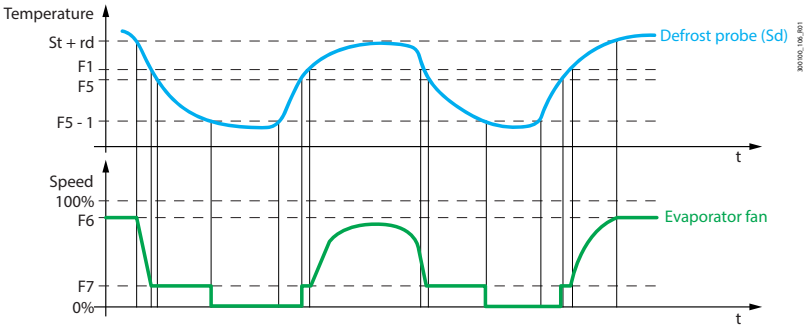
If parameter F0=2, the evaporator fan speed is modulated based on the evaporator temperature alone, with the speed increasing the further it falls below F1.



Ref.	Description
Sv	Control probe
F1	Fan activation threshold
Frd	Differential
F5	Fan cut-off temperature
F6	Maximum evaporator fan speed
F7	Minimum evaporator fan speed
t	time
Speed	Evaporator fan speed

Fig. 6.ak

If parameter F0=3, the evaporator fan speed is modulated based on the control temperature alone, with the speed increasing the further it rises above the set point.



Ref.	Description
Sv	Control probe
F1	Fan activation threshold
Frd	Differential
St	Temperature control set point
rd	Temperature control differential
F5	Fan cut-off temperature
F6	Maximum evaporator fan speed
F7	Minimum evaporator fan speed
t	Time
Speed	Evaporator fan speed

Fig. 6.al

Notice: The behaviour of the variable speed fans can be influenced not only by the "cooling" request and by the temperature, but also by other control functions (dehumidification, humidification and heating), if available.

Advanced evaporator fan parameters

Due to the mechanical inertia of the motor, some EC fans cannot start at the minimum speed set by parameter F7. To solve this problem, the fans can start at the maximum speed set by parameter F6 for a "start-up time", defined by parameter F8, regardless of the defrost temperature Sd. Vice-versa, if the fan operates too long at low speed, ice may form on the blades; to avoid this, at intervals of every F10 minutes, the fan is switched on at maximum speed for the time set for parameter F8.

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

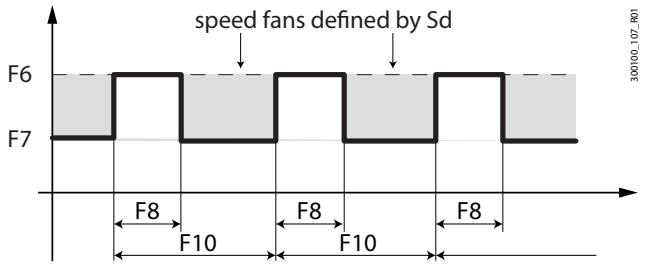


Fig. 6.am

6.18 Condenser fans

The condenser fans can be fixed speed (On/Off) or variable speed (modulating 0-10 V).

Notice: variable speed fans are only available on models with analogue outputs Y1 and Y2, PWM or 0-10 V, see "Introduction".

To assign the On/Off or modulating output, use the parameters shown in the table.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOt	Assign condenser fan digital output - see DOA	0	0	6	-	M	NO
rOt	Condenser fan digital output logic - see rOA	0	0	1	-	M	NO
/AE	Assign analogue output for modulating condenser fan - see /AA	0	0	2	-	M	NO
/P5	Configuration of analogue output Y1: 7 = 0-10 V; 8 = PWM	8	7	8	-	S	NO
/P6	Configuration of analogue output Y1: 7 = 0-10 V; 8 = PWM	8	7	8	-	S	NO

Notice: if an analogue output is assigned to the variable-speed condenser fan function and the condenser fan is also assigned to a relay output, both outputs will be active at the same time; if the speed is greater than 0, the relay will remain active (closed):

- if speed (Y2) > 0 → "FAN" relay ON (NO* closed);
- if speed (Y2) = 0 → "FAN" relay OFF (NO* open).

6.18.1 Fixed-speed condenser fans

To activate the algorithm, simply assign a relay output to the condenser fan function. The condensing temperature probe also needs to be configured if required for control. See "Inputs and outputs".
The parameters used to manage fixed-speed fans are shown below (see the connection diagram).

Par.	Description	Def	Min	Max	UOM	User	User terminal
F00	Condenser fan management: 0 = Always on with compressor on; 1 = Activation based on Sc, off with compressor off.	0	0	3	-	S	NO
F4	Condenser fan deactivation temperature	40/104	-50/-58	200/392	°C/°F	S	NO
F5d	Condenser fan activation differential	5/9	0.1/0.2	60/108	°C/°F	S	NO

iJM manages the condenser fans as follows:
- F00 = 0 on when the compressor is on;
- F00 = 1 on/off based on the condensing temperature probe Sc; off with the compressor off.

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

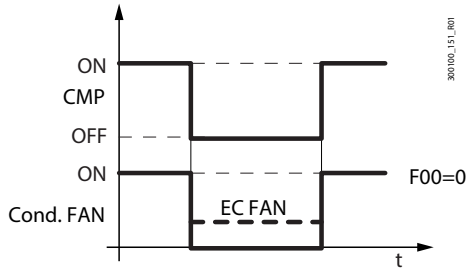


Fig. 6.an

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 (3.6°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.

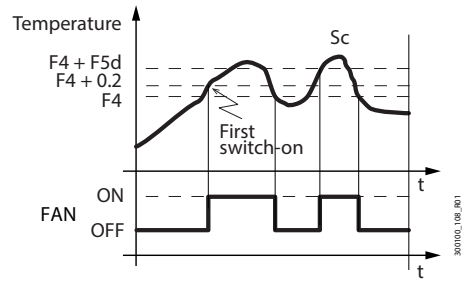


Fig. 6.ao

Ref.	Description
Sc	Condensing temperature probe
F4	Fan deactivation threshold
F5d	Differential
t	time
FAN	Condenser fans

6.18.2 Variable-speed condenser fans (EC fans)

Variable-speed fans may be useful for optimising energy consumption. In this case, the fans are powered by the mains, while the control signal may come via output Y1 or Y2 on the iJM controller, set as 0-10 Vdc.

Notice: variable speed fans are only available on models with analogue outputs Y1 and Y2, PWM or 0-10 V, see "Introduction".

To activate the algorithm, simply assign an analogue output to the variable-speed condenser fan function by setting the type of output accordingly. The condensing temperature probe also needs to be configured. See "Inputs and outputs".

The maximum and minimum fan speed can be set using parameters FCH and FCL (as a percentage of the range 0-10 V). The fan speed varies proportionally across the range of modulation. For example, if Sc=F4-F5d/2 –› output Y2 corresponds to the percentage (FCH + FCL)/2.
If using the fan speed controller, F4 represents the temperature below which the fans are deactivated, with a deactivation hysteresis equal to FCC.

Par.	Description	Def	Min	Max	UOM	User	User terminal
FCC	Modulating condenser fan cut-off temperature	2/3.6	0	50/90	°C/°F	M	NO
FCL	Minimum modulating condenser fan speed	0	0	100	%	M	NO
FCH	Maximum modulating condenser fan speed	100	0	100	%	M	NO

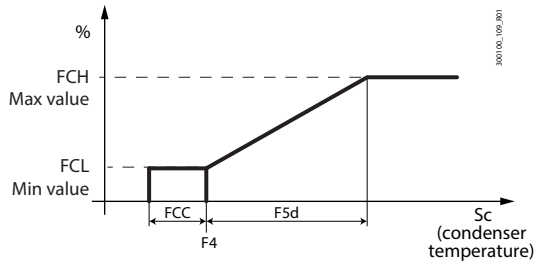


Fig. 6.ap

Ref.	Description
Sc	Condenser probe
F4	Fan deactivation threshold
F5d	Differential
FCC	Fan cut-off temperature
FCH	Maximum speed
FCL	Minimum speed

6.19 Light management

The light can be controlled by several sources: button, supervisor, door switch, curtain switch and time band.
The light is switched on or off based on an event:

Light	Action
Button	Pressing the button
Supervisor	Variation of the value from the supervisor (parameter Lht)
Door switch	Contact transition (opening/closing)
Curtain switch	Contact transition (opening/closing)
Time band	based on the on/off day, hours, minutes

Tab. 6.m

When the digital inputs are stable (door switch or curtain switch), the light can be switched on and off from the keypad or supervisor.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOE	Assign light digital output - see DOA	4	0	6	-	M	NO
rOE	Light digital output logic - see rOA	0	0	1	-	S	NO
/AF	Assign analogue output for modulating lights - see /AA	0	0	2	-	M	NO
HL	Modulating light output activation percentage: 0 = 0%; 1 = 25%; 2 = 50%: 3 = 75%; 4 = 100%	2	0	4	-	U	NO

By setting the analogue output as a light (on part numbers where available), the output can be modulated with four intensity levels, using parameter HL (0, 25, 50, 75 and 100%).

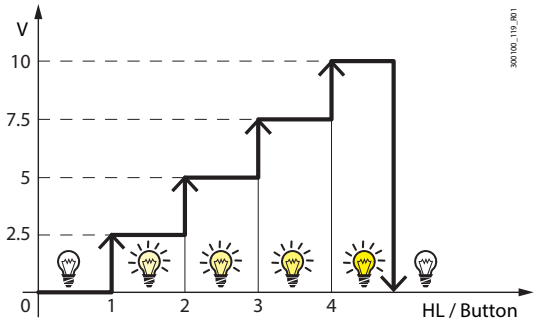


Fig. 6.aq

6.20 Door management

iJM can manage the opening of the door with or without stopping temperature control, based on the setting of the door switch.

Par.	Description	Def	Min	Max	UOM	User	User terminal
DIE	Assign door switch with compressor OFF - see DIA	0	0	4	-	M	NO
DIP	Assign door switch without compressor OFF - see DIA	0	0	4	-	M	NO
rIE	Door switch with compressor OFF digital input logic - see rIA	0	0	1	-	S	NO
rIP	Door switch without compressor OFF digital input logic - see rIA	0	0	1	-	S	NO

If the digital input is configured as a door switch with compressor off (parameter DIE), when the door is opened both the compressor and the evaporator fans are stopped; on the other hand, if configured as a door switch without compressor off (parameter DIP), when the door is opened only the evaporator fans are stopped.

Par.	Description	Def	Min	Max	UOM	User	User terminal
H14	Time light stays on after closing the door	0	0	240	min	U	NO
Ad	Delay time for high and low temperature alarms (AH, AL)	120	0	240	min	U	YES
Add	High temperature alarm bypass time for door open	5	1	240	min	U	YES

When the door is open, the high temperature alarm is ignored for the time set using parameter Add, to avoid false alarms, and the service icon flashes to signal a warning condition. When time Add has elapsed, the following occur:
- the open door alarm (dor) is signalled;
- compressor and evaporator fan control resumes;
- the light stays on;
- after the delay time set by parameter Ad, the high temperature alarm is activated.

When closing the door:
- control resumes, restarting the compressor and evaporator fans if required;
- the light switches off after the time set by parameter H14 and the high temperature alarm is activated after the delay Ad.

When control resumes, the compressor safety times c1 and c2 are observed.

6.21 Door - light interactions

The behaviour of the light when the door is opened depends on whether the time bands are set, whether these are associated with the light output by setting parameter H8, and on the value set for parameter H14.

Par.	Description	Def	Min	Max	UOM	User	User terminal
H8	Output switched with time bands: 0 = Light; 1 = AUX	0	0	1	-	S	NO
H14	Time light stays on after closing the door	0	0	240	min	U	No
r60	Night mode activation delay	4	0	90	h	M	NO
tE1...8-d	End time band 1 to 8 - day, see (td1...8-d)	0	0	11	-	U	NO
tE1...8-hh	End time band 1 to 8 - hours	0	0	23	hours	U	NO
tE1...8-mm	End time band 1 to 8 - minutes	0	0	59	minutes	U	NO
tE1...8-time	End time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-	U	NO
tS1...8-d	Start time band 1 to 8 - day, see (td1...8-d)	0	0	11	-	U	NO
tS1...8-hh	Start time band 1 to 8 - hours	0	0	23	hours	U	NO
tS1...8-mm	Start time band 1 to 8 - minutes	0	0	59	minutes	U	NO
tS1...8-time	Start time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-	U	NO

Time bands not set

In the absence of time bands, opening the door always activates normal operating mode, which lasts until a different mode is selected via under interface, supervisor or after the time set for r60. The light switches on when the door is opened and switches off when it closes, with a delay equal to H14, if set.

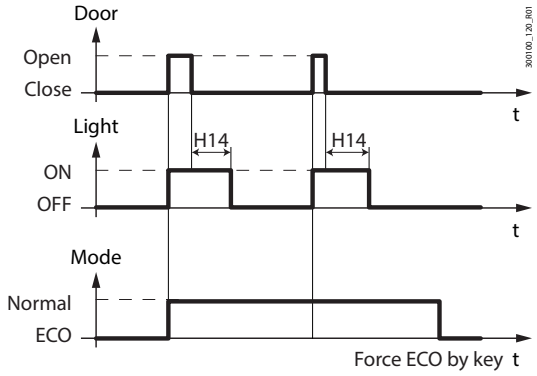


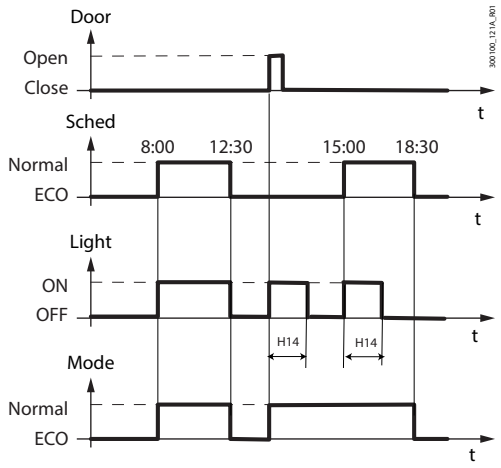
Fig. 6.ar

Ref.	Description
Door	Door switch
Light	Light output
Mode	Normal/ECO mode
H14	Light off delay after closing the door
t	Time

Time bands set, H8 = 0

If the time bands are set to define normal/ECO operating mode and the bands are associated with the light output by setting parameter H8 = 0, the behaviour varies according to the value set for parameter H14.

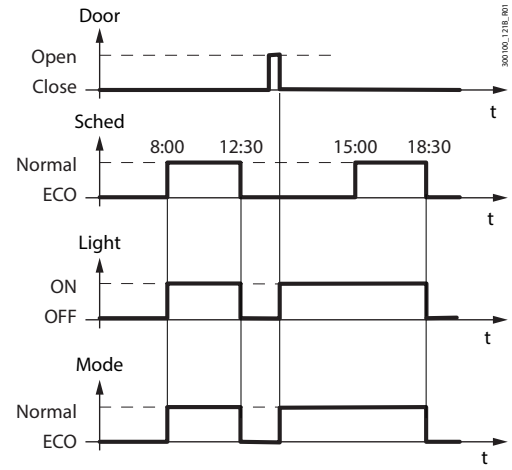
If H14 ≠ 0, opening the door will switch back to normal mode and switch on the light. When the door is closed, the controller remains in normal operating mode and the light switches off after a delay equal to H14. At each subsequent transition to normal mode, the light will remain on for the time set for H14.



Ref.	Description
Door	Door switch
Sched	Time bands
Light	Light output
Mode	Normal/ECO mode
H14	Light off delay after closing the door
t	Time

Fig. 6.as

If H14 = 0 the light is based on the operating mode, normal or ECO, and is therefore on during normal operation and off during ECO operation.

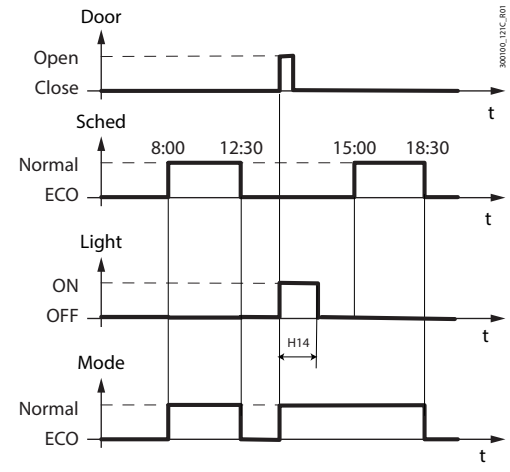


Ref.	Description
Door	Door switch
Sched	Time bands
Light	Light output
Mode	Normal/ECO mode
t	Time

Fig. 6.at

Time bands set, H8 = 1

If the time bands are set to define the operating mode, normal or ECO; and the bands are associated with the AUX output instead of the light by setting H8 = 1, the light will follow the logic for the door, switching on and off when door opens and closes respectively, with a possible delay of H14.



Ref.	Description
Door	Door switch
Sched	Time bands
Light	Light output
Mode	Normal/ECO mode
H14	Light off delay after closing the door
t	Time

Fig. 6.au

6.22 Curtain management

Par.	Description	Def	Min	Max	UOM	User	User terminal
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	NO
rIG	Curtain switch digital input logic - see rIA	0	0	1	-	S	NO

If the digital input is associated with the curtain switch, when the curtain is closed the iJM controller activates ECO mode and the set point is modified by adding the value of parameter r4. When the curtain is open, the light is always switched on.

Notice: in eco mode, the value St+r4 is used for all of the functions that involve the set point (e.g. relative high and low temperature alarms, control with dead band, two-stage compressor control, etc.).

6.23 Generic functions

iJM can exploit unused inputs and outputs to configure a "generic function". Each generic function can be enabled/disabled in the Applica app or Spark program.

Caution: the generic functions available vary according to the model of controller.

The following can be activated (maximum configuration):
- 1 generic function with On/Off output;
- 1 generic function with modulating output (only for models where this is available);
- 1 generic alarm function (signal only).

The generic function can be controlled based on one of the following:
- 1 specific probe;
- 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.

6.23.1 Enabling

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
GFA_E	Generic alarm function, enable 0 = Always 1 = Unit ON 2 = Unit OFF 3 = Defrost 4 = Not used 5 = Continuous cycle 6 = Duty setting 7 = Standby 8 = Compressor or reverse output active 9 = Open door 10 = Active alarm	0	0	10	-	S	NO
GFM_E	Generic modulating function, enable - see GFA_E	0	0	10	-	S	NO
GFS_E	Generic On/Off function, enable - see GFA_E	0	0	10	-	S	NO

Assign control probe

Select the control probes for the generic function.

Par.	Description	Def	Min	Max	UOM	User	User terminal
GFA_1	Generic alarm function, control probe 1 0 = Not configured 1 = Air off temperature (Sm) 2 = Defrost temperature (Sd) 3 = Air on temperature (Sr) 4 = Not used; 5 = Not used; 6 = Not used 7 = Auxiliary probe 1 8 = Auxiliary probe 2 9 = Ambient temperature 10 = Not used 11 = Glass temperature 12 = Not used 13 = Condensing temperature 14 = Not used 15 = Frost protection temperature 16 = Product temperature 17 = Not used 18 = Power present 19 = Evaporator fan request 20 = Control probe	0	0	20	-	S	NO
GFA_2	Generic alarm function, control probe 2 - see GFA_1	0	0	20	-	S	NO
GFM_1	Generic modulating function: control probe 1- see GFA_1	0	0	20	-	S	NO
GFM_2	Generic modulating function: control probe 2- see GFA_1	0	0	20	-	S	NO
GFA_1	Generic On/Off function: control probe 1 - see GFA_1	0	0	20	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFA_1	0	0	20	-	S	NO

6.23.2 On/Off output

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

Par.	Description	Def	Min	Max	UOM	User	User terminal
DOS	Assign generic On/Off function digital output - see DOA	0	0	6	-	M	NO
rOS	Generic On/Off function digital output logic - see rOA	0	0	1	-	S	NO
GFS_D	Generic On/Off function, differential	0	0	99.9	-	S	NO
GFS_S	Generic On/Off function: set point	0	-99	999	-	S	NO
GFS_T	Generic On/Off function: type 0= Direct; 1= Reverse	0	0	1	-	S	NO

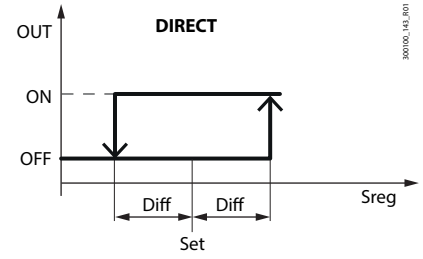


Fig. 6.av

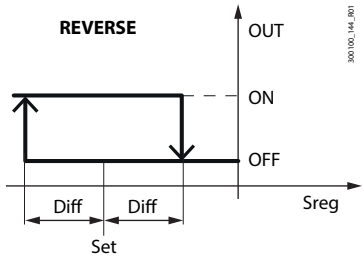


Fig. 6.aw

Ref.	Description
Set	Set point (GFS_S)
Diff	Differential (GFS_D)
Sreg	Control probe 1 *or* Control probe1 - Control probe 2
OUT	Digital output

6.23.3 Modulating output

Notice: the generic function with modulating output is only available on models with analogue outputs Y1 and Y2, PWM or 0-10 V, see "Introduction".

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.

Par.	Description	Def	Min	Max	UOM	User	User terminal
/Ad	Assign analogue output for modulating generic function - see /AA	0	0	2	-	M	NO
/P5	Configuration of analogue output Y1: 7 = 0-10 V; 8 = PWM	8	7	8	-	S	NO
/P6	Configuration of analogue output Y2: 7 = 0-10 V; 8 = PWM	8	7	8	-	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_H	Generic modulating function, hysteresis	0.1	0.1	20	-	S	NO
GFM_Kp	Generic modulating function, proportional gain	0	0	100	-	S	NO
GFM_Max	Generic modulating function, max output value	0	0	100	%	S	NO
GFM_Min	Generic modulating function, min output value	0	0	100	%	S	NO
GFM_S	Generic modulating function, set point	0	-99	999	-	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

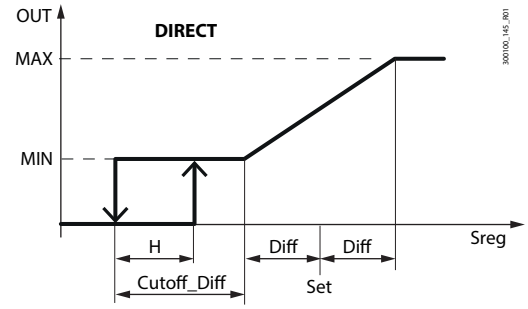


Fig. 6.ax

Ref.	Description
Set	Set point (GFM_S)
Diff	Differential (GFM_D)
H	Hysteresis (GFM_H)
Sreg	Control probe 1 *or* Control probe1 - Control probe 2
OUT	Digital output
CutOff_Diff	Cut-off differential (GFM_CD)

6.23.4 Alarm signal

The alarm can be signalled 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 for a time longer than GFA_De: the display shows GHI or GLO respectively.

Notice: check that the alarm is generated by only one of the two causes.

Par.	Description	Def	Min	Max	UOM	User	User terminal
GFA_D	Generic alarm function: differential	0	0	99.9	-	S	NO
GFA_De	General alarm function: delay	0	0	30000	s	S	NO
GFA_Ht	Generic alarm function: high temperature threshold	0	GFA_Lth	999	-	S	NO
GFA_Lth	Generic alarm function: low temperature threshold	0	-99	GFA_Ht	-	S	NO

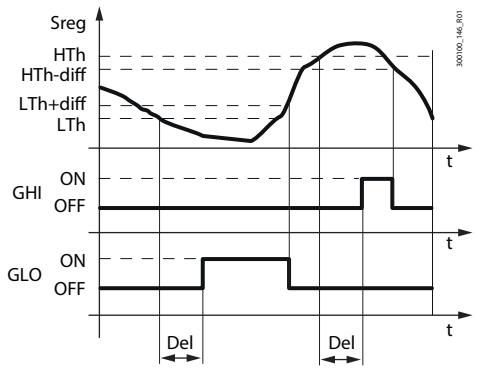


Fig. 6.ay

Ref.	Description
Lth	Low temperature threshold (GFA_Lth)
HTh	High temperature threshold (GFA_Hth)
diff	Differential (GFA_D)
Del	Delay (GFA_De)
Sreg	Control probe 1 *or* Control probe1 - Control probe 2
t	Time
GHI	High temperature alarm message
GLO	Low temperature alarm message

6.24 Temperature monitoring

The iJM controller can record the minimum value rL and maximum value rH read by one of the probes, selected by setting parameter r5c, across a time interval rt spanning from the last reset by parameter rtL to the present. The monitoring session can be reset at any time, after which the new maximum and minimum values are logged. Monitoring is active when parameter rM is set to 1.

Par.	Description	Def	Min	Max	UOM	User	User terminal
rM	Enable temperature monitoring: 0 = Disabled; 1 = Enabled	0	0	1	-	S	NO
r5c	Select probe to monitor 0 = Not configured 1 = Air off temperature (Sm) 2 = Defrost temperature (Sd) 3 = Air on temperature (Sr) 4 = Not used; 5 = Not used; 6 = Not used 7 = Auxiliary probe 1 8 = Auxiliary probe 2 9 = Ambient temperature 10 = Not used 11 = Glass temperature 12 = Not used 13 = Condensing temperature 14 = Not used 15 = Frost protection temperature 16 = Product temperature	3	0	16	-	M	NO
rtL	Reset monitoring period	0	0	1	-	U	NO

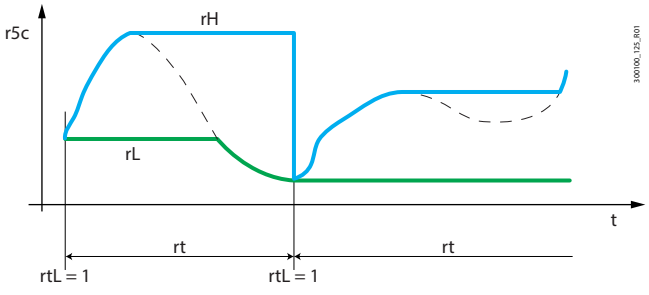


Fig. 6.az

Ref.	Description
rtL	reset, restart monitoring
rL	minimum temperature value in the monitored period
rH	maximum temperature value in the monitored period
rt	Monitoring period
rSc	Variable monitored
t	time

Notice: temperature monitoring can only be activated on models fitted with RTC and with the clock set correctly.

6.25 High and low voltage (HLV) readings

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

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

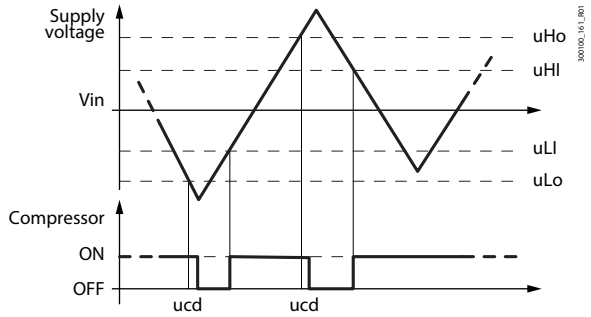


Fig. 6.ba

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

Caution:

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

7. PARAMETER TABLE

Below is the table of the parameters that can be displayed on the terminal or can be modified using the configuration software or Applica app. The Applica app and configuration tools for iJM have three predefined parameter access levels: User (U), Service (S) and Manufacturer (M). The default passwords to access the Service and Manufacturer parameters from the Applica app are 22 and 44 respectively. The Manufacturer level password also allows access to the Service parameters, and the level S password also allows access to the User parameters.

Par.	Description	Def	Min	Max	UOM	User	User terminal
PDM	Manufacturer password (OEM)	44	0	999	-	M	NO
PDS	Service password	22	0	999	-	S	NO
PDU	User password	0	0	999	-	U	NO

Notice:

- the read-only parameters are not visible from the Applica app using NFC, as NFC memory cannot be overwritten frequently;
- to avoid any fraudulent activities, the default password values should be changed at the end of the commissioning procedure. For example, with the Applica app, parameters PDM, PDS and PDU can be used to set new passwords, with a maximum length of 3 numbers.

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

7.1 Parameter table

Code	Description	Def.	Min	Max	UOM	User	User term.
/2	Analogue probe measurement stability: 0 = Probe reading not delayed; … 9 = Maximum probe reading delay.	5	0	9	-	M	NO
/4	Virtual probe composition: 0 = Air off probe Sm; 100 = Air on probe Sr.	0	0	100	%	S	NO
/5	Unit of measure: 0 = °C; 1 = °F.	0	0	1	-	U	YES
/6	Display decimal point: 0 = Yes; 1 = No.	0	0	1	-	S	YES
/8	Mitigation algorithm, display offset	0	-99/ - 178.2	99/178.2	Δ °C/°F	M	NO
/9	Mitigation algorithm, minimum value displayed	-3.5/ 25.7	-40/ -40	199/ 390.2	°C/°F	M	NO
/A	Mitigation algorithm, maximum value displayed	3/ 37.4	-40/ -40	199/ 390.2	°C/°F	M	NO
/AA	Assign analogue output for modulating evaporator fan: 0 = Not configured; 1 = Analogue output 1 (Y1); 2 = Analogue output 2 (Y2).	0	0	2	-	M	NO
/Ad	Assign analogue output for modulating generic function - see /AA	0	0	2	-	M	NO
/AE	Assign analogue output for modulating condenser fan - see /AA	0	0	2	-	M	NO
/AF	Assign analogue output for modulating lights - see /AA	0	0	2	-	M	NO
/AG	Assign analogue output for modulating compressor - see /AA	0	0	2	-	M	NO
/b	Mitigation algorithm, alarm signal threshold	13/ 55.4	-40/ -40	199/ 390.2	°C/°F	M	NO
/cA	Outlet temperature probe (Sm) calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cb	Defrost temperature probe (Sd) calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cc	Intake temperature probe (Sr) calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cg	Auxiliary temperature probe 1 calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cH	Auxiliary temperature probe 2 calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cI	Room temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/co	Condensing temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/cr	Product temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/°F	S	NO
/d1	Assign end defrost probe: 1 = Air off temperature (Sm); 2 = Defrost temperature (Sd); 3 = Air on temperature (Sr); 4 = Not used; 5 = Not used; 6 = Not used; 7 = Auxiliary probe 1; 8 = Auxiliary probe 2; 9 = Ambient temperature; 10 = Not used; 11 = Glass temperature; 12 = Not used; 13 = Condensing temperature; 14 = Not used; 15 = Frost protection temperature; 16 = Product temperature	2	1	16	-	M	NO
/E	Mitigation algorithm, filter intensity (0 = function disabled)	0	0	50	-	M	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
/FA	Assign outlet temperature probe (Sm) 0 = Function disabled 1 = Probe S1 2 = Probe S2 3 = Probe S3 4= Reserved; 5 = Reserved 6 = Probe S1H 7 = Reserved	1	0	7	-	M	NO
/Fb	Assign defrost temperature probe (Sd) - see /FA	0	0	7	-	M	NO
/Fc	Assign intake temperature probe (Sr) - see /FA	0	0	7	-	M	NO
/FG	Assign auxiliary temperature probe 1 (Saux1) - see /FA	0	0	7	-	M	NO
/FH	Assign auxiliary temperature probe 2 (Saux1) - see /FA	0	0	7	-	M	NO
/FI	Assign room temperature probe (SA) - see /FA	0	0	7	-	M	NO
/Fo	Assign condensing temperature probe - see /FA	0	0	7	-	M	NO
/FR	Assign product temperature probe - see /FA	0	0	7	-	M	NO
/Lb	Status LEDs on in standby (including ON/OFF): 0 = Off; 1 = On.	0	0	1	-	M	NO
/nE	Enable user terminal navigation: 0 = Enabled; 1 = Disabled.	0	0	1	-	M	NO
/P1	Configure probe type S1, S2, S3: 0 = PT1000; 1 = PTC; 2 = NTC; 3 = NTC-LT; 4 = NTC-HT.	2	0	4	-	S	NO
/P2	Configuration of multifunction input S3/ DI1: 0, 1, 2, 3, 4 = S3; 5 = DI1.	5	0	5	-	S	NO
/P5	Configuration of analogue output Y1: 7 = 0-10 V; 8 = PWM.	8	7	8	-	S	NO
/P6	Configuration of analogue output Y2: 7 = 0-10 V; 8 = PWM.	8	7	8	-	S	NO
/P7	Configuration of multifunction input S1H/ ID1H: 2 = S1H (NTC); 3, 4 = Reserved; 5 = ID1H.	2	2	5	-	S	NO
/Sb	PRG button always ON in standby: 0 = off; 1 = on.	1	0	1	-	M	NO
/t1	Display on user terminal: 0 = Not configured 1 = Value of S1; 2 = Value of S2; 3 = Value of S3 4 = Not available 5 = Value of S1H 6 to 8 = Not available 9 = Control probe 10 = Virtual probe 11 to 14 = Not available 15 = Actual control set point	9	0	15	-	S	YES
A0	High and low temperature alarm reset differential	2/ 3.6	0.1/0.2	20/ 36	Δ °C/°F	M	NO
A1	Alarm thresholds (AL, AH) relative to the set point St or absolute: 0 = Relative; 1 = Absolute.	0	0	1	-	S	NO
A3	Defrost terminated after maximum time signal: 0 = Disabled; 1 = Enabled.	0	0	1	-	S	NO
A6	Stop compressor with external alarm (Toff = 15 minutes, fixed): 0 = compressor always OFF; 100 = compressor always ON.	0	0	100	min	M	NO
A7	Delay time for delayed external alarm (0 = signal-only alarm)	0	0	240	min	M	NO
Ac	Dirty condenser alarm threshold	70/158	0/ 32	250/482	°C/°F	M	NO
Acd	Dirty condenser alarm delay time	0	0	240	min	M	NO
Ad	Delay time for high and low temperature alarms (AH, AL)	120	0	240	min	U	YES
Add	High temperature alarm bypass time for door open	5	1	240	min	U	YES
AE	Dirty condenser alarm reset differential	5	0.1/0.2	20/ 36	Δ °C/°F	M	NO
AH	Relative high temperature alarm threshold	0	0	555/999	Δ °C/°F	U	YES
AHA	Absolute high temperature alarm threshold	537/999	-100/-148	537/999	°C/°F	U	YES
AL	Relative low temperature alarm threshold	0	0	200/360	Δ °C/°F	U	YES
ALA	Absolute low temperature alarm threshold	-100/-148	-100/-148	537/999	°C/°F	U	YES
AuC	Activate auxiliary output	0	0	1	-	S	NO
BtE	Enable Bluetooth™ connection: 0 = Disabled; 1 = Enabled.	1	0	1	-	M	NO
c0	Delay to enable compressor and evaporator fan at power on	0	0	15	min	M	NO
c1	Min time between consecutive compressor starts	0	0	15	min	M	NO
c11	Second compressor start delay	4	0	250	s	M	NO
c2	Min compressor OFF time	3	0	15	min	M	NO
c3	Min compressor ON time	0	0	15	min	M	NO
c4	ON time for duty setting operation (Toff = 15 minutes, fixed value): 0 = compressor always OFF; 100 = compressor/valve always ON	0	0	100	min	M	NO
c7	Defrost priority over continuous cycle: 0 = continuous cycle has priority; 1 = defrost has priority.	0	0	1	-	M	NO
cc	Continuous cycle running time (0 = disabled)	4	0	72	hours	M	NO
ccE	Set point delta to end continuous cycle	0.0	0.0	9.9/ 17.8	Δ °C/°F	M	NO
cct	VCC compressor off time	1	0	255	min	(**)	NO
cdf	VCC compressor frequency for hot gas defrost	140	0	255	hz	(**)	NO
cdt	VCC compressor PID control derivative term	1	0	255	s	(**)	NO
cMA	Maximum VCC compressor rotation frequency	150	0	250	hz	(**)	NO
cMf	Maximum VCC compressor control frequency	100	0	255	hz	(**)	NO
cMi	VCC compressor switch-off frequency	30	0	250	hz	(**)	NO
CnC	Start continuous cycle	0	0	1	-	S	NO
cnf	Minimum VCC compressor control frequency	52	0	255	hz	(**)	NO
cntRes	Reset counter	0	0	1	-	S	NO
cntResDoor	Reset door opening count	0	0	1	-	S	NO
CoA	Display alarms detected by the inverter: 0 = display disabled; 1 = display enabled.	1	0	1	-	(**)	YES
cPr	VCC compressor PID control proportional term	2	0	800	-	(**)	NO
cSc	Soft start frequency	53	0	255	hz	(**)	NO
cSt	Soft start time	5	0	240	s	(**)	NO
Ctd	Maximum VCC inverter communication failure time before alarm is shown on the display (0 = display disabled)	15	0	60	s	(**)	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
ctI	VCC compressor PID control integral term	120	0	999	s	(**)	NO
cuF	Conversion factor from frequency (Hz) to compressor speed (rpm)	30	0	999	-	(**)	NO
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	-	M	NO
d10	Compressor OFF time running time defrost - 0 = function disabled	0	0	240	min	M	NO
d11	Defrost temperature threshold in running time mode	-50/ -58	-50/ -58	50/ 122	°C/°F	M	NO
d15	Start defrost threshold	0	0	240	min	M	NO
d16	Time with no temperature decrease before starting defrost	30	Add	240	min	M	NO
d20	Sampling time for alarm rSF	0	0	240	min	M	NO
d21	Number of defrosts allowed before signalling alarm rSF	2	1	5	-	M	NO
d22	Temperature difference to verify decrease	0.1/ 0.2	0.1/ 0.2	0.5/ 0.9	Δ °C/°F	M	NO
d4	Enable defrost at power on: 0 = Disabled; 1 = Enabled.	0	0	1	-	M	NO
d5	Defrost delay at start-up or after command from digital input	0	0	240	min	M	NO
d6	Display on terminal during defrost: 0 = temperature alternating with 'dEF'; 1 = freeze display; 2 = 'dEF'.	1	0	2	-	S	YES
d7	Skip defrost: 0 = Disabled; 1 = Enabled.	0	0	1	-	M	NO
d8	Bypass high temperature alarm time after defrost	1	1	240	hours	S	YES
d9	Defrost priority over compressor protection times: 0 = the compressor protection times are observed; 1 = the compressor protection times are ignored, therefore defrosting starts without waiting for the compressor protection times to elapse	0	0	1	-	M	NO
dAS	Activate ECO mode	0	0	1	-	U	NO
dC	Time base for defrosts: 0 = dI in hours, dP1 in minutes; 1 = dI in minutes, dP1 in seconds.	0	0	1	-	S	NO
dC1	Time base for d8: 0 = d8 in hours; 1 = d8 in minutes	0	0	1	-	S	NO
dCH	Defrost after opening the door: maximum number of openings	50	dcL	99	-	M	NO
dcL	Defrost after opening the door: minimum number of openings	0	0	dCH	-	M	NO
dd	Dripping time after defrosting (0 = no dripping)	2	0	15	min	M	NO
ddF	VCC compressor frequency for dripping	140	cMi	255	hz	(**)	NO
dfM	Start defrost	0	0	1	-	U	NO
dHG	Waiting time for compressor start to reverse cycle	0	0	300	s	M	NO
dI	Maximum interval between consecutive defrosts	8	0	240	hours	S	YES
DIA	Assign immediate external alarm digital input: 0 = Disabled; 1 = ID1; 2 = ID2; 3 = D1H; 4 = reserved.	0	0	4	-	M	NO
DIb	Assign delayed external alarm digital input - see DIA	0	0	4	-	M	NO
DIc	Assign enable defrost digital input - see DIA	0	0	4	-	M	NO
DId	Assign start defrost digital input - see DIA	0	0	4	-	M	NO
DIE	Assign door switch with compressor OFF digital input - see DIA	0	0	4	-	M	NO
DIF	Assign remote ON/OFF digital input - see DIA	0	0	4	-	M	NO
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	NO
DIH	Assign start/stop continuous cycle digital input - see DIA	0	0	4	-	M	NO
DIo	Assign working parameter set changeover digital input - see DIA	0	0	4	-	M	NO
DIP	Assign door switch without compressor OFF digital input - see DIA	0	0	4	-	M	NO
DIS	Assign generic function alarm digital input logic - see DIA	0	0	4	-	M	NO
DIt	Assign low pressure switch digital input - see DIA	0	0	4	-	M	NO
DIU	Assign AUX output activation digital input - see DIA	0	0	4	-	M	NO
dn	Nominal defrost duration for skip defrost	75	0	100	%	M	NO
DOA	Assogn solenoid/compressor digital output 0 = Not configured 1 = digital output 1 (NO1) 2 = digital output 2 (NO2) 3 = digital output 3 (NO3) 4 = digital output 4 (NO4) 5 = Reserved 6 = Reserved	1	0	6	-	M	NO
DOb	Assign alarm digital output - see DOA	0	0	6	-	M	NO
DOC	Assign AUX auxiliary digital output - see DOA	0	0	6	-	M	NO
DOE	Assign light digital output - see DOA	4	0	6	-	M	NO
DOG	Assign defrost digital output - see DOA	2	0	6	-	M	NO
DOI	Assign evaporator fan digital output - see DOA	3	0	6	-	M	NO
DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	6	-	M	NO
DOS	Assign generic On/Off function digital output - see DOA	0	0	6	-	M	NO
DOt	Assign condenser fan digital output - see DOA	0	0	6	-	M	NO
dP1	Maximum defrost duration	45	1	240	min	S	YES
dPH	Defrost after opening the door: maximum defrost duration	15	dPL	dP1	min	M	NO
dPL	Defrost after opening the door: minimum defrost duration	5	0	dPH	min	M	NO
dS1	Compressor off time in sequential stop defrost mode (0 = function disabled)	0	0	45	min	M	NO
dS2	Compressor operating time in sequential stop defrost mode	120	0	240	min	M	NO
dt1	End defrost temperature (read by Sd)	4/39.2	-50/ -58	50/ 122	°C/°F	S	YES
F0	Evaporator fan management: 0 = Always on; 1 = Activation based on Sd – Sv; 2 = Activation based on Sd; 3 = Activation based on Sv.	0	0	3	-	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
F1	Evaporator fan activation threshold (only if F0 = 1, 2, 3)	5/ 41	-50/ -58	200/ 392	°C/°F	S	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
F10	Evaporator fan forcing time at maximum speed (0 = function disabled)	0	0	240	min	M	NO
F2	Evaporator fans with compressor off: 0 = See F0; 1 = Always off with compressor off; 2 = On for anti-stratification; 3 = Reserved	1	0	3	-	S	NO
F3	Evaporator fans during defrost: 0 = On; 1 = Off.	1	0	1	-	S	NO
F4	Condenser fan deactivation temperature	40/ 104	-50/ -58	200/ 392	°C/°F	S	NO
F5	Evaporator fan cut-off temperature (hysteresis 1 °C)	5/41	F1	200/392	°C/°F	M	NO
F5d	Condenser fan activation differential	5/ 9	0.1/ 0.2	60/ 108	Δ °C/ °F	S	NO
F6	Maximum evaporator fan speed	100	F7	100	%	M	NO
F7	Minimum evaporator fan speed	0	0	F6	%	M	NO
F8	Evaporator fan start-up time (0 = function disabled)	0	0	240	s	M	NO
FCC	Modulating condenser fan cut-off temperature	2/ 3.6	0	50/ 90	°C/°F	M	NO
FCH	Maximum modulating condenser fan speed	100	0	100	%	M	NO
FCL	Minimum modulating condenser fan speed	0	0	100	%	M	NO
Fct_ALr_disable	Disable "Display alarms" direct function: 0 = Direct function visible (if available) 1 = Direct function not visible	0	0	1	-	(**)	NO
Fct_Auc_disable	Disable "Activate auxiliary output" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_BtE_disable	Disable "Enable Bluetooth" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_dFM_disable	Disable "Activate defrost" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Don_disable	Disable DOWN button in the direct functions menu: 0 = Button enabled (if available); 1 = Button disabled.	0	0	1	-	(**)	NO
Fct_Ec1_disable	Disable "Upload embedded configuration 1" direct functions - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Ec2_disable	Disable "Upload embedded configuration 2" direct functions - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Eco_disable	Disable "Activate ECO mode" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Ent_disable	Disable ENTER button in the direct functions menu - see Fct_Don_disable	0	0	1	-	(**)	NO
Fct_Esc_disable	Disable ESC button in the direct functions menu - see Fct_Don_disable	0	0	1	-	(**)	NO
Fct_Fr_disable	Disable "Firmware version" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_HL_disable	Disable "Dim lights" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Lht_disable	Disable "Switch on lights" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_nFE_disable	Disable "Enable NFC memory" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_OnF_disable	Disable "Unit On/Off" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Pd_disable	Disable "Start pull down" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Prg_disable	Disable PROG button in the direct functions menu - see Fct_Don_disable	0	0	1	-	(**)	NO
Fct_rH_disable	Disable "Maximum control probe value" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_rL_disable	Disable "Minimum control probe value" direct function - see see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_rtL_disable	Disable "Reset min/max control probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_SAh_disable	Disable "View alarm log" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sc_disable	Disable "Condenser ng probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sc1_disable	Disable "Set quick set point 1" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sc2_disable	Disable "Set quick set point 2" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sc3_disable	Disable "Set quick set point 3" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sd_disable	Disable "Defrost probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Sm_disable	Disable "Air off probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_SPr_disable	Disable "Product probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_SrG_disable	Disable "Control probe" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_St_disable	Disable "Set control set point" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_UmA_disable	Disable "Summer/winter" direct function - see Fct_ALr_disable	0	0	1	-	(**)	NO
Fct_Up_disable	Disable UP button in the direct functions menu - see Fct_Don_disable	0	0	1	-	(**)	NO
Fd	Post-dripping time after defrost (fans off with control active)	2	0	15	min	M	NO
Fd0	Evaporator fan ON time for anti-stratification during the day	5	1	100	min	M	NO
FdF	Evaporator fan OFF time for anti-stratification during the day (0 = always ON during the day)	10	0	100	min	M	NO
Fn0	Evaporator fan ON time for anti-stratification at night	5	1	100	min	M	NO
FnF	Evaporator fan OFF time for anti-stratification at night (0 = always ON at night)	20	0	100	min	M	NO
Fpd	Evaporator fans during post-dripping: 0 = on; 1 = off	1	0	1	-	M	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
Frd	Evaporator fan activation differential (also variable speed)	2/ 3.6	0.1/ 0.2	20/ 36	Δ °C/°F	S	NO
GFA_1	Generic alarm function, control probe 1 0 = Not configured; 1 = Air off temperature (Sm); 2 = Defrost temperature (Sd); 3 = Air on temperature (Sr); 4 = Not used; 5 = Not used; 6 = Not used; 7 = Auxiliary probe 1; 8 = Auxiliary probe 2; 9 = Ambient temperature; 10 = Not used; 11 = Glass temperature; 12 = Not used; 13 = Condensing temperature; 14 = Not used; 15 = Frost protection temperature; 16 = Product temperature.	0	0	16	-	S	NO
GFA_2	Generic alarm function, control probe 2 - see GFA_1	0	0	20	-	S	NO
GFA_D	Generic alarm function, differential	0.1	0.1	99.9	-	S	NO
GFA_De	General alarm function, delay	0	0	30000	S	S	NO
GFA_E	Generic alarm function, enable 0 = Always; 1 = Unit ON; 2 = Unit OFF; 3 = Defrost; 4 = Not used; 5 = Continuous cycle; 6 = Duty setting; 7 = Not used; 8 = Compressor or reverse output active; 9 = Open door; 10 = Active alarm.	8	0	10	-	S	NO
GFA_Hth	Generic alarm function, high temperature threshold	0	GFA_Lth	999	-	S	NO
GFA_Lth	Generic alarm function, low temperature threshold	0	-99	GFA_Hth	-	S	NO
GFM_1	Generic modulating function, control probe 1 - see GFA_1	0	0	20	-	S	NO
GFM_2	Generic modulating function, control probe 2 - see GFA_1	0	0	20	-	S	NO
GFM_CD	Generic modulating function, cut-off differential	0.1	0.1	20	-	S	NO
GFM_D	Generic modulating function, differential	0.1	0.1	99.9	-	S	NO
GFM_E	Generic modulating function, enable - see GFA_E	8	0	10	-	S	NO
GFM_H	Generic modulating function, hysteresis	0.1	0.1	20	-	S	NO
GFM_Kp	Generic modulating function, proportional gain	0	0	100	-	S	NO
GFM_Max	Generic modulating function, max output value	0	0	100	%	S	NO
GFM_Min	Generic modulating function, min output value	0	0	100	%	S	NO
GFM_S	Generic modulating function, set point	0	-99	999	-	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
GFS_1	Generic On/Off function: control probe 1 - see GFA_1	0	0	16	-	S	NO
GFS_2	Generic On/Off function: control probe 2 - see GFA_1	0	0	16	-	S	NO
GFS_D	Generic On/Off function, differential	0	0	99.9	-	S	NO
GFS_E	Generic On/Off function, enable - see GFA_E	8	0	10	-	S	NO
GFS_S	Generic On/Off function: set point	0	-99	999	-	S	NO
GFS_T	Generic On/Off function, type: 0 = direct; 1 = reverse.	0	0	1	-	S	NO
H0	Serial address	1	1	247	-	S	YES
H10	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	8	-	S	YES
H11	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
H14	Time light stays on after closing the door	0	0	240	min	U	NO
H8	Output switched with time bands: 0 = Light; 1 = AUX.	0	0	1	-	S	NO
Hb	Buzzer: 0 = Disabled; 1 = Enabled.	1	0	1	-	U	YES
HL	Modulating light output activation percentage: 0 = 0%: 1 = 25%; 2 = 50%: 3 = 75%; 4 = 100%.	2	0	4	-	U	NO
HMP	Operating hour threshold for maintenance alarm	hx1000	0	45	0	M	NO
HMr	Reset operating hours	-	0	1	0	S	NO
HU	Humidity level: 0 = Low; 1 = Medium; 2 = High.	1	0	2	-	U	YES
IS	Working configuration	0	0	IS_Max	-	S	YES
IS_max	Number of embedded configurations (read-only)	0	0	999		M	NO
Lht	Switch on light command	0	0	1	-	U	NO
MA1	Test mode, activate analogue output 1: 0 = Deactivated; 1 = Automatic; 2 = Activated at value of MAr1.	0	0	1	-	S	NO
MA2	Test mode, activate analogue output 2 - see MA1	0	0	1	-	S	NO
MAr1	Test mode, analogue output 1 request	0	0	100	%	S	NO
MAr2	Test mode, analogue output 2 request	0	0	100	%	S	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
Mr1	Test mode, activate relay1: 0 = Deactivated; 1 = Automatic; 2 = Activated.	1	0	2	-	S	NO
Mr2	Test mode, activate relay 2 - see Mr1	1	0	2	-	S	NO
Mr3	Test mode, activate relay 3 - see Mr1	1	0	2	-	S	NO
Mr4	Test mode, activate relay 4 - see Mr1	1	0	2	-	S	NO
Mt	Manual mode duration (0 = manual mode always active)	10	0	90	min	S	NO
nFE	Enable NFC memory: 0 = Parameter copying disabled; 1 = Parameter copying enabled.	1	0	1	-	M	NO
odL	Long door opening count threshold	20	0	255	s	M	NO
odS	Short door opening count threshold	2	0	255	s	M	NO
On	On/Off command 0 = Off; 1 = On.	1	0	1	-	U	YES (button)
PDM	Manufacturer password (OEM)	44	0	999	-	M	NO
PDS	Service password	22	0	999	-	S	NO
PDU	User password	0	0	999	-	U	NO
PEI	ECO mode available during pull down: 0= Available; 1 = Not available.	1	0	1	-	M	NO
Pt	Automatic pull down activation temperature	30/ 86	0/0	127/ 260.6	°C/°F	M	NO
r1	Minimum set point	-50/ -58	-99/ - 146.2	r2	°C/°F	M	NO
r2	Maximum set point	50/ 122	r1	200/ 392	°C/°F	M	NO
r4	Automatic night set point variation	3/5.4	-50/ -90	50/ 90	Δ °C/°F	S	NO
r4d	Temperature control differential in ECO mode	4/ 7.2	0.1/ 0.2	99.9/179.2	Δ °C/°F	S	NO
r5c	Select probe to monitor: 0 = Not configured; 1 = Air off temperature (Sm); 2 = Defrost temperature (Sd); 3 = Air on temperature (Sr); 4 = Not used; 5 = Not used; 6 = Not used; 7 = Auxiliary probe 1; 8 = Auxiliary probe 2; 9 = Ambient temperature; 10 = Not used; 11 = Glass temperature; 12 = Not used; 13 = Condensing temperature; 14 = Not used; 15 = Frost protection temperature; 16 = Product temperature.	3	0	16	-	M	NO
r60	Night mode activation delay	4	0	90	h	M	NO
r6a	Control probe for night operation: 0: Virtual probe (Sv) 1 = Air on temperature probe Sr	0	0	1	-	S	NO
r70	Night mode duration	6	0	90	h	M	NO
r9	Time for disabling ECO mode after pull down	0	0	1440	min	M	NO
rAL	Reset alarm log	0	0	1	-	S	YES
rd	Temperature control differential	2/ 3.6	0.1/ 0.2	99.9/179.2	Δ °C/°F	S	YES
rIA	Immediate external alarm digital input logic: 0 = Direct logic; 1 = Reverse logic.	0	0	1	-	S	NO
rIb	Delayed external alarm digital input logic - see rIA	0	0	1	-	S	NO
rIc	Enable defrost digital input logic - see rIA	0	0	1	-	S	NO
rId	Start defrost digital input logic - see rIA	0	0	1	-	S	NO
rIE	Door switch with compressor OFF digital input logic - see rIA	0	0	1	-	S	NO
rIF	Remote ON/OFF digital input logic - see rIA	0	0	1	-	S	NO
rIG	Curtain switch digital input logic - see rIA	0	0	1	-	S	NO
Rih	Start/stop continuous cycle digital input logic - see rIA	0	0	1	-	S	NO
rIo	Working parameter set changeover digital input logic - see rIA	0	0	1	-	S	NO
rIP	Door switch without compressor OFF digital input logic - see rIA	0	0	1	-	S	NO
rIS	Generic function alarm digital input logic - see rIA	0	0	1	-	S	NO
rIt	Low pressure switch digital input logic - see rIA	0	0	1	-	S	NO
rIU	AUX output activation digital input logic - see rIA	0	0	1	-	S	NO
rM	Enable temperature monitoring: 0 = Disabled; 1 = Enabled	0	0	1	-	S	YES
ro	Control offset with probe error	0	0	20/ 36	Δ °C/°F	M	NO
rOA	Compressor digital output logic: 0 = Direct, 1 = Reverse	0	0	1	-	S	NO
rOb	Alarm digital output logic - see rOA	0	0	1	-	S	NO
rOc	Auxiliary digital output logic - see rOA	0	0	1	-	S	NO
rOE	Light digital output logic - see rOA	0	0	1	-	S	NO
rOG	Defrost digital output logic - see rOA	0	0	1	-	S	NO
rOI	Evaporator fan digital output logic - see rOA	0	0	1	-	S	NO
rOk	Auxiliary compressor without rotation digital output logic - see rOA	0	0	1	-	S	NO
rOS	Generic On/Off function digital output logic - see rOA	0	0	1	-	S	NO
rOt	Condenser fan digital output logic - see rOA	0	0	1	-	S	NO
rS1	Working parameter set associated with open digital input (See par. DIo)	1	0	IS_max	-	M	NO
rS2	Working parameter set associated with closed digital input (See par. DIo)	2	0	IS_max	-	M	NO
rSA	Reset alarms	0	0	1	-	S	YES
rSC	Restore default values	0	0	1	-	S	YES
rtL	Reset monitoring period	0	0	1	-	U	YES
Sc1	Custom temperature set point 1	0	r1	r2	°C/°F	M	NO

Code	Description	Def.	Min	Max	UOM	User	User term.
Sc2	Custom temperature set point 2	0	r1	r2	°C/°F	M	NO
Sc3	Custom temperature set point 3	0	r1	r2	°C/°F	M	NO
St	Temperature control set point	50/ 122	r1	r2	°C/°F	U	YES
St_Idx	Custom set point index	0	0	3	-	M	NO
StU	Control set point in winter mode	5/ 41	r1	r2	°C/°F	M	NO
td1..8-d	Defrost 1 to 8 - day: 0 = Event disabled; 1 to 7 = Monday, ..., Sunday; 8 = Monday to Friday; 9 = Monday to Saturday; 10 = Saturday & Sunday; 11 = Every day.	0	0	11	-	U	NO
td1..8-hh	Defrost 1 to 8 - hours	0	0	23	hours	U	NO
td1..8-mm	Defrost 1 to 8 - minutes	0	0	59	minutes	U	NO
td1..8-time	Defrost 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-	U	NO
tE1...8-d	End time band 1 to 8 - day, see (td1...8-d)	0	0	11	-	U	NO
tE1...8-hh	End time band 1 to 8 - hours	0	0	23	hours	U	NO
tE1...8-mm	End time band 1 to 8 - minutes	0	0	59	minutes	U	NO
tE1...8-time	End time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-	U	NO
tS1...8-d	Start time band 1 to 8 - day, see (td1...8-d)	0	0	11	-	U	NO
tS1...8-hh	Start time band 1 to 8 - hours	0	0	23	hours	U	NO
tS1...8-mm	Start time band 1 to 8 - minutes	0	0	59	minutes	U	NO
tS1...8-time	Start time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-	U	NO
ucd	Compressor stop delay after HLV activated	5	0	60	s	M	NO
udE	Enable display of HLV alarms (EHI and ELO, see alarm table)	0	0	1	-	M	NO
uEn	Enable read HLV: 0 = Disabled; 1 = Enabled.	0	0	1	-	M	NO
uHi	High voltage protection start threshold	245	0	350	V	M	NO
uHo	High voltage protection end threshold	255	0	350	V	M	NO
uLi	Low voltage protection start threshold	205	0	350	V	M	NO
uLo	Low voltage protection end threshold	195	0	350	V	M	NO
UmA	Activate winter mode	0	0	1	-	M	NO

Tab. 7.a

(*) Parameter only available via BMS serial.
(**) Parameter only available via the configuration tool.

7.2 Configure the iJM controller via the Applica app

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

Procedure:

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

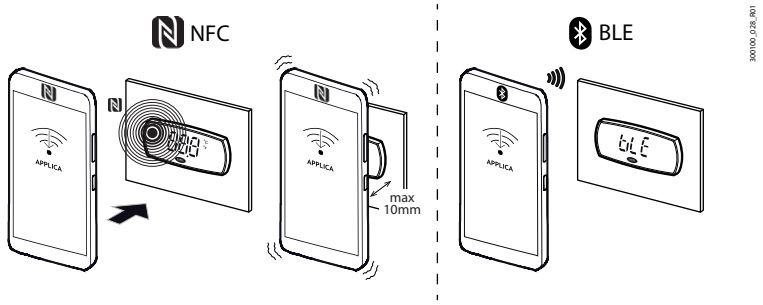


Fig. 7.a

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

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

7.2.1 Configurations

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

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

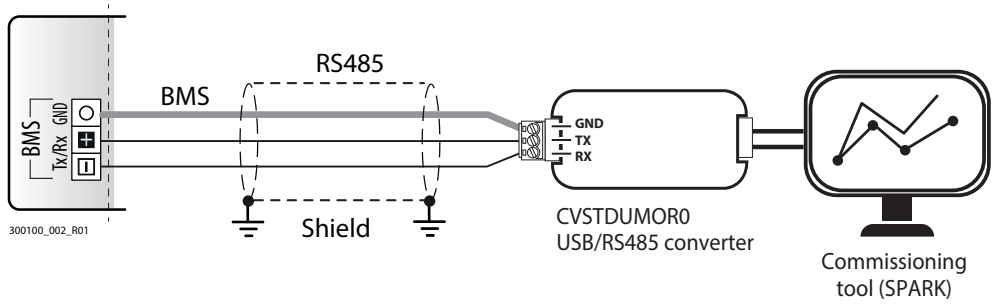


Fig. 7.b

Proceed as follows:

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

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

7.2.2 Profiles

Different profiles can be created for displaying the parameters using the configuration software.
Proceed as follows:

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

8. TECHNICAL SPECIFICATIONS

Physical specifications	Case	Polycarbonate
	Ball pressure test temperature	125°C
	Ingress protection	IEC: • Rear: IP20 • Front: IP65 (Panel small, HMI small); IP45 (Split small without HMI cable); IP20 (Split with HMI cable) UL: • Type 1
	Front cleaning	Use soft, non-abrasive cloth and neutral detergent or water
Environmental conditions	Operating temperature	-20T60 °C, <90% RH non-condensing -20T60 °C, <90% RH condensing, only for mod. BCU**********02 and BCU**********03
	Storage temperature	-40T80°C, <90% RH non-condensing; -20T80°C, <90% RH non condensing for models with battery
Electrical specifications	Rated power supply	• 100-240 Vac (Panel small, Split small); • 12 Vdc, supplied by Carel controller SELV/Class 2 (HMI)
	Operating power supply voltage	• 90-264 Vac (Panel, Split); • 12 Vdc, supplied by Carel controller SELV/Class 2 (HMI)
	Input frequency	50/60Hz (Panel small, Split small)
	Maximum current draw	• 100 mA rms (Panel small, Split small); • 200 mA, power supply supplied by Carel controller SELV/Class 2 (HMI)
	Min power consumption	700 mW
	Clock	Precision: 20 ppm at 25°C; 100 ppm in the temperature range -20T60 °C. Date/time storage with controller off up to 10 years for models with battery (-20T60°C).
	Software class and structure	A
	Environmental pollution class	2 (Panel small, Split small); 3 (HMI).
	Class of protection against electric shock	To be incorporated in class I or II appliances
	Type of action and disconnection	1.C
	Rated impulse voltage	100 - 240 Vac input and relay output: 2.5 kV (Panel small, Split small) 0.5 kV (HMI)
	Surge immunity category	100 - 240 Vac input and relay outputs: II (Panel small, Split small)
	Control device construction	Device to be incorporated
	Terminal block	NO1, NO2, C1, NO3, NO4, NO5, C5, C6, NC6, NO6, L, N: • Plug-in male-female 30-12 AWG/0.05-3.3 mm² • Screw terminals 30-14 AWG/0.05-2 mm² • Spade connectors S1, S2, S3, DI1, DI2, S1H, D1H, GND: • Plug-in male-female 30-17 AWG/0.05-1 mm² • Screw terminals 30-17 AWG/0.05-1 mm² BMS: • Plug-in male-female 30-17 AWG/0.05-1 mm² 0-10 V/PWM: • JST ZH connector 32-26 AWG/0.03-0.13 mm² Power supply and communication with Carel controller (HMI): • JST ZH connector 32-26 AWG/0.03-0.13 mm² • Plug-in male-female 30-17 AWG/0.05-1 mm² • Screw terminals 30-17 AWG/0.05-1 mm²
	Purpose of the controller	Electrical control device
User interface	Buzzer	Built-in (Panel small, HMI)
	Display	3 digits, decimal point and multifunction icons (Panel, HMI); external HMI (optional, Split small)
	Keypad	Max 3 buttons (Panel small, HMI small); External HMI (optional, Split small)
	LED	1 red LED and 1 white LED (Split small)
Connectivity	NFC	Max distance 10 mm, variable according to the mobile device used
	Bluetooth Low Energy (opt.)	Max distance 10 m, variable according to the mobile device used
	BMS serial interface (opt.)	RS485 not optically-isolated
	HMI interface	RS485 not optically-isolated
	TTL serial interface (opt.)	Not opto-isolated, 3.3 V power supply, Maximum number of devices connected: 1

Analogue inputs (Lmax=10m)	S1, S2, S3: NTC/ NTC-HT/ NTC-LT/ PT1000/ PTC	NTC: resolution 0.1°C; 10 kΩ@25°C; beta 3435; error: ±1 °C in the range -50T50°C, ±3 °C in the range 50T90°C
		NTC-HT: resolution 0.1°C; 50 kΩ@25°C; beta 3977; error: ±1.5°C in the range -15T115°C, ±4°C in the range 40T-15°C and 115T150°C:
		NTC_LT: resolution 0.1°C; 750Ω@25°C; beta 3969; error: ±1.5°C in the range -20T10°C, ±4°C in the range 80T-20°C and 10T55°C
		PT1000: resolution 0.1°C; 1 kΩ@0°C; error: ± 1°C in the range - 60T120°C
		PTC: resolution 0.1°C; 985 Ω@25°C; error: ±2 °C in the range -50T50°C, ±4 °C in the range 50T150°C
	S1H: D1H configurable as NTC	NTC: resolution 0.1°C; 10 kΩ@25°C; beta 3435; error: ±1°C in the range -50T50°C, ±3°C in the range 50T90°C
Digital inputs	DI1, DI2 configurable as fast digital inputs	Voltage-free contact, not optically-isolated, typical closing current 5 mA, voltage with contact open 12 V, max contact resistance 50 Ω Fast digital inputs: 0-10 V: error 2 % fs, typical 1 %
	D1H (HMI)	Voltage-free contact, not optically-isolated, typical closing current 5 mA, voltage with contact open 12 V, max contact resistance 50 Ω
Analogue outputs	Y1, Y2, independently configurable as DC or PWM outputs (opt.)	0-10V: 1 kΩ ,10 mA max
		PWM: 100 Hz, max amplitude 10 V, 10 mA max
Digital outputs (Small)	NO1, NO2, NO3, NO4 **Notice:** with screw or plug-in terminals, NO1: max 12A. • NO1: max 12 A; • NO2+NO3+NO4: max 12 A With faston terminals: • NO1: max 14 A; • NO2+NO3+NO4: max • 14 A	NO1 (2 hp): EN60730: 10(6) A, 250 Vac; UL60730: 16A, 250 Vac; 8FLA, 48LRA, 250 Vac; Pilot duty B300, 250 Vac
		NO2 (8 A): EN60730: 8(3) A, 240 Vac; UL60730: 8A, 240 Vac; 2FLA, 12LRA, 240 Vac; Pilot duty C300, 240 Vac
		NO3, NO4 (5 A): EN60730: 5(1) A, 240 Vac; UL60730: 5A, 240 Vac; 1FLA, 6LRA, 240 Vac; Pilot duty C300, 240 Vac
Cable lengths	Analogue inputs/outputs, digital inputs/ outputs, probe power	< 10 m
	BMS serial (RS485):	< 500 m with shielded cable
	BMS serial (TTL)	< 2 m
	Controller-HMI	< 10 m. NOTICE: in domestic environments, for connections over 2 m, in applications where controller and HMI are not installed on the same chassis, shielded cable is recommended
Conformity	Electrical safety compliance - LVD directive and UL certification	IEC/EN/UL 60730-1, CSA E60730-1, IEC 60335-1 (sections 29 & 30)
	Electromagnetic compatibility - EMC directive	IEC/EN 61000-6-1, IEC/EN 61000-6-2, IEC/EN 61000-6-3, IEC/EN 61000-6-4
	For use with flammable refrigerants, the controllers described in this document have been tested and found to comply with the following requirements of the IEC 60335 series standards: • Annex CC of IEC 60335-2-24: 2010, referred to in clause 22.109, and Annex BB of IEC 60335-2-89: 2010, referred to in clause 22.108; components that produce arcs or sparks during normal operation have been tested and found to comply with the requirements of UL/IEC 60079-15; • IEC/EN/UL 60335-2-24 (clauses 22.109, 22.110) for household refrigerators and freezers; • IEC/EN/UL 60335-2-40 (clauses 22.116, 22.117) for electric heat pumps, air conditioners and dehumidifiers; • IEC/EN/UL 60335-2-89 (clauses 22.108, 22.109) for commercial refrigerating appliances. The controllers have been verified for the maximum temperatures of all components, which during the tests required by IEC 60335 cl. 11 and 19 do not exceed 272°C. The acceptability of these controllers in the final application where flammable refrigerants are used needs to be reviewed and verified depending on the final application.	
	Wireless compliance	RED directive (EN 301489-1), FCC (section 15, subsection B), IC.
	Environmental compliance	EN 60068-2-52 sev. 3, for part numbers BCU**********03
		EN 60068-2-38, for part numbers BCU**********02 & BCU**********03 (internal tests)

Tab. 8.a

8.1 Connector/cable table

Ref.	Description	Wiring terminals	Wire size (mm2)	Lmax (m)
L, N	Controller power supply	Plug-in screw terminal, 2-pin, pitch 5 mm (Small without options)/5.08mm (Small with options)	0.05-3.3 (30-12 AWG)	10
		Screw terminals, 2-pin, pitch 5 mm (Small without options)/5.08 mm (Small with options)	0.05-2 (30-14 AWG)	
		Spade connectors	-	
S1...S3	Probes	Plug-in terminal; 5-pin, pitch 3.81 mm (Small, without options) 2x3 pins, pitch 3.5 mm (Small, with options)	0.05-3.3 (30-12 AWG)	10
		Screw terminals: 5-pin, pitch 3.81 mm (Small, without options) 2x3 pins, pitch 3.5 mm (Small, with options)	0.05-2 (30-14 AWG)	
S1H	HMI probe	Plug-in terminal, pins, pitch	0.05-1 (30-17 AWG)	10
		Screw terminal		
ID1, ID2	Digital inputs	Plug-in screw terminal, 5-pin, pitch 5.08 mm (Small, without options) 2x3 pins, pitch 3.5 mm (Small, with options)	0.05-3.3 (30-12 AWG)	10
		Screw terminals, 5-pin, pitch 5.08 mm (Small without options) 2x3 pins, pitch 3.5 mm (Small, with options)	0.05-2 (30-14 AWG)	
ID1H	HMI digital input	Plug-in screw terminal, 5-pin, pitch 3.5 mm	0.05-1 (30-17 AWG)	10
		Screw terminals, 5-pin, pitch 3.5 mm		
NO1...NO6	Digital outputs	5-pin plug-in terminal	0.05-3.3 (30-12 AWG)	10
		5-pin screw terminals	0.05-2 (30-14 AWG)	
		Spade connectors	-	
Y1, Y2	0-10 V/PWM outputs	JST ZH connector, 4-pin, pitch 2 mm - Connection cable part number (see "Introduction")	0.03-13 (32-26 AWG)	10
BMS	BMS serial port (RS485):	Removable screw terminal, 3-pin, pitch 3.5 mm	0.05-1 (30-17 AWG)	500, with shielded cable, cross section at least 0.33 mm^2 (22 AWG)
TTL	BMS serial (TTL)	JST ZH connector, 4-pin, pitch 2 mm - Connection cable part number (see "Introduction").	0.03-13 (32-26 AWG)	2
VCC	VCC serial output	JST ZH connector, 4-pin, pitch 2 mm - Connection cable part number (see "Introduction")	0.03-13 (32-26 AWG)	500, 6 with shielded cable
HMI	HMI remote terminal	JST ZH connector, 4-pin, pitch 2 mm - Connection cable part number (see "Introduction")	0.03-13 (32-26 AWG)	10 **Notice:** in domestic environments, for connections over 2 m, in applications where controller and HMI are not installed on the same chassis, shielded cable is recommended
		Plug-in screw terminal, 4-pin, pitch 5.08 mm	0.05-1 (30-17 AWG)	
		Screw terminals, 4-pin, pitch 5.08 mm		

Tab. 8.b

9. ALARMS AND SIGNALS

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.

Display code	Description
Ble	Bluetooth™ connection in progress
dEF	Defrost running
Loc	Display locked
Off	Switch OFF
On	Switch ON

Tab. 9.a

9.2 Types of alarms

The iJM controller can display two types of malfunctions:

- **warning**, when this type of error occurs, the alarm code is shown on the display, alternating with the main value, and the "Service" icon is shown on the display, however the buzzer does not sound, no relay is activated; some signals fall under this category, e.g. defrost ended due to maximum time, dirty condenser, HACCP alarms, configuration errors.
- **alarms**, when this type of error occurs, the alarm code is shown on the display, alternating with the main value, and the "Service" icon comes on, the buzzer flashes and the relay is activated; this category includes alarms for which with the relay is configured as an alarm, probe errors, temperature alarms, frost protection, communication errors with the VCC compressor, power supply over and under voltage, etc.

Notice:

- the digital outputs can be configured to signal the alarm status, normally open or normally closed. See "Digital outputs".
- An alarm can also be activated from an external contact, immediate or delayed. See "Digital inputs".

The warning and alarm signals can be immediate or delayed by parameter (see the Alarm table).
Both warnings and alarms can be reset automatically, manually or semi-automatically:

- **automatic**, when the cause is no longer present, the alarm also ceases;
- **manual**, when the cause is no longer present, the alarm remains active until manually reset by parameter;
- **semi-automatic**, reset is automatic 3 times in an hour, after which manual reset is required.

Active alarms are signalled by the buzzer (see parameter Hb) and the flashing of the "Service" icon. The alarm code is shown on the display, alternating with the main value. Pressing any button mutes the buzzer. If more than one error occurs, these are displayed in sequence. When an alarm is cleared, it is stored in the alarm log containing a maximum of five alarms, in a FIFO list (the 6th alarm overwrites the 1st alarm, and so on). The error log can be accessed from the user terminal, via supervisor or Applica app (Bluetooth connection only).

Example
Display after HI error.

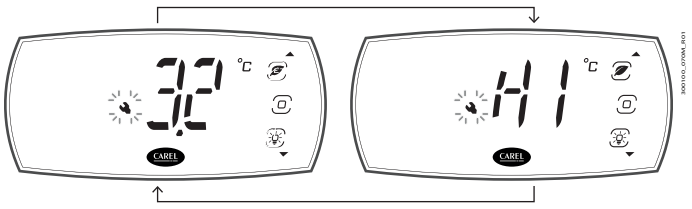


Fig. 9.a

The alarms can be reset manually using parameter rSA, from the user terminal or configuration tool, or in Applica (Bluetooth connection only) using the specific command on the Alarms page ("Service" or "Manufacturer" level access is required). If the condition that generated the alarm is still present, the alarm will be reactivated after resetting.
The alarm log can be deleted using parameter rAL, accessible from the user terminal, configuration tool or in Applica (Bluetooth connection only) using the specific command on the Alarms page ("Service" or "Manufacturer" level access is required).

Notice: deleting the alarm log is irreversible.

9.3 Alarm table

Display code	Log code (*)	Description	Delay (default)	Icon on display	Alarm relay	Buzzer	Reset	Effects on control
CE	28	Configuration write error	-	NO	NO	NO	Automatic	-
cht	17	High condenser temperature warning	-	NO	NO	NO	Automatic	-
CHt	18	High condenser temperature alarm	Acd (0 min)	NO	NO	NO	Manual	Compressor shutdown
COM	34	VCC communication error	Ctd (15 s)	YES	YES	YES	Automatic	-
dA	14	Delayed alarm from external contact	A7 (1 min)	YES	YES	YES	Automatic	Compressor operation in duty setting mode (par. A6); lights and auxiliary output OFF
dor	15	Door open	Add (5 s)	YES	YES	YES	Automatic	See "Door management"
E1	1	Probe 1 faulty or disconnected	-	NO	NO	NO	Automatic	Based on associated function
E2	2	Probe 2 faulty or disconnected	-	NO	NO	NO	Automatic	
E3	3	Probe 3 faulty or disconnected	-	NO	NO	NO	Automatic	
E5	5	Probe 5 faulty or disconnected	-	NO	NO	NO	Automatic	
E6	6	Probe S1H faulty or disconnected	-	NO	NO	NO	Automatic	
Ed1	10	Defrost terminated after maximum time	-	NO	NO	NO	Automatic	-
EHI	36	High power supply voltage alarm	-	YES	YES	YES	Automatic	-
ELO	37	Low power supply voltage alarm	-	YES	YES	YES	Automatic	-
Etc	9	Clock error	-	NO	NO	NO	Manual	Time bands disabled
GHI	19	Generic alarm high threshold	GFA_De (0 s)	YES	YES	YES	Automatic	-
GLO	20	Generic alarm low threshold	GFA_De (0 s)	YES	YES	YES	Automatic	-
HI	24	High temperature	Ad (120 s)	YES	YES	YES	Automatic	-
IA	13	Immediate alarm from external contact	-	YES	YES	YES	Automatic	Compressor operation in duty setting mode (par. A6)
LO	23	Low temperature	Ad (120 s)	YES	YES	YES	Automatic	-
LP	32	Low pressure	-	YES	YES	YES	Semi-automatic	Compressor shutdown
MAn	38	Output status forced to manual mode	-	YES	YES	YES	Automatic	-
rE	12	Control probe faulty or disconnected	-	YES	YES	YES	Automatic	Compressor operation in duty setting mode (par. c4)
rSF	31	Refrigerant leak alarm	-	YES	YES	YES	Manual	Switch off all actuators
SF	27	Configuration not completed correctly	-	NO	NO	NO	Manual	-
SrC	35	Maintenance request	-	YES	YES	YES	Manual	-
UCF	33	VCC operation error	-	YES	YES	YES	Automatic	-

Tab. 9.b

(*) This is the code used to record and display the alarm in Applica.

9.4 Low and high temperature alarms LO and HI

The high and low temperature alarm thresholds can be relative or absolute, depending on the value of parameter A1:

- A1 = 0: the relative thresholds AL and AH are considered and represent the deviation from the set point; the low temperature alarm is activated at set point - AL, and the high temperature alarm at set point + AH. If the set point changes, the alarm activation point also changes automatically.
- A1 = 1, the absolute thresholds ALA and AHA are considered, representing the absolute low temperature and high temperature alarm threshold, respectively. If the set point changes, the activation point remains the same.

Par.	Description	Def	Min	Max	UOM	User	User terminal
d8	Bypass high temperature alarm time after defrost	30	1	240	min	S	YES
A0	High and low temperature alarm reset differential	2	0.1	20	°C/°F	M	NO
A1	Alarm thresholds (AL, AH) relative to the set point St or absolute: 0 = relative; 1 = absolute	0	0	1	-	S	YES
A6	Stop compressor with external alarm (Toff = 15 minutes, fixed): 0 = compressor always OFF; 100 = compressor always ON	0	0	100	min	M	NO
Ad	Delay time for high and low temperature alarms (AH, AL)	120	0	240	min	U	YES
Add	High temperature alarm bypass time for door open	30	1	240	min	U	YES
AH	Relative high temperature alarm threshold	0	0	555/999	Δ °C/°F	U	YES
AHA	Absolute high temperature alarm threshold	537/999	-100/-148	537/999	°C/°F	U	YES
AL	Relative low temperature alarm threshold	0	0	200/360	Δ °C/°F	U	YES
ALA	Absolute low temperature alarm threshold	-100/-148	-100/-148	537/999	°C/°F	U	YES

Tab. 9.c

Relative thresholds

Parameter AL is used to set the activation threshold for the low temperature alarm LO. The value measured by the control probe is continuously compared against the value of St-AL, and if it falls below this value for a time longer than Ad, the low temperature alarm LO is activated. The low temperature alarm LO ceases automatically when the temperature rises back above St-AL+A0.

Similarly, parameter AH is used to set the activation threshold for the high temperature alarm HI. The value measured by the control probe is continuously compared against the value of St+AH, and if it rises above this value for a time longer than Ad, the high temperature alarm HI is activated. The high temperature alarm HI ceases automatically when the probe reading falls below St+AH-A0.

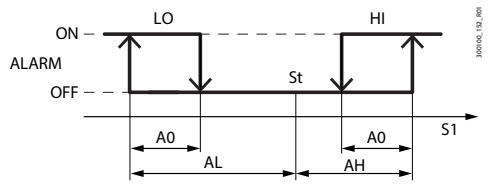


Fig. 9.b

Ref.	Description
LO	Low temperature alarm
HI	High temperature alarm
S1	Control probe
St	Set point
AL	Relative low temperature alarm threshold
AH	Relative high temperature alarm threshold
A0	Return differential

Absolute thresholds

Parameter ALA is used to set the activation threshold for the low temperature alarm LO. The value measured by the control probe is continuously compared against the value of ALA, and if it falls below this value for a time longer than Ad, the low temperature alarm LO is activated. The low temperature alarm LO ceases automatically when the temperature rises back above ALA+A0.
Similarly, parameter AHA is used to set the activation threshold for the high temperature alarm HI. The value measured by the control probe is continuously compared against the value of AHA, and if it rises above this value for a time longer than Ad, the high temperature alarm HI is activated.
The high temperature alarm HI ceases automatically when the probe reading falls below AHA-A0.

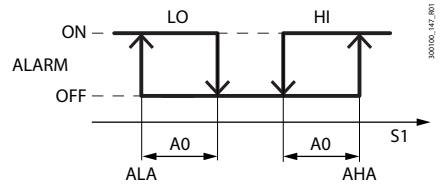


Fig. 9.c

Ref.	Description
LO	Low temperature alarm
HI	High temperature alarm
S1	Control probe
AL	Low temperature alarm threshold
AH	High temperature alarm threshold
A0	Return differential

The high temperature alarm is ignored for a time set by parameter Add after opening the door, and for parameter d8 after defrosting, to avoid false signals. Once the times set by parameter Add or d8 have elapsed, the delay set by parameter Ad starts counting and the alarm is signalled when it elapses.
The active low temperature alarm LO is signalled by the buzzer and the code LO shown on the display, while the active high temperature alarm HI is signalled by the buzzer and the code HI.

9.5 Dirty condenser alarm

If the condensing temperature probe is fitted, the iJM controller can monitor the reading so as to signal a dirty condenser alarm.

Par.	Description	Def.	Min	Max	UOM	User	User terminal
/Fo	Assign condensing temperature probe: 0 disabled — 4 Reserved 1 S1 — 5 Reserved 2 S2 — 6 S1H 3 S3 — 7 Reserved	0	0	7	-	S	NO
Ac	Dirty condenser alarm threshold	70/158	0/32	250/482	°C/°F	S	NO
AE	Dirty condenser alarm differential	5/9	0.1/0.2	20/36	Δ °C/ °F	M	NO
ACd	Dirty condenser alarm delay	0	0	240	min	M	NO

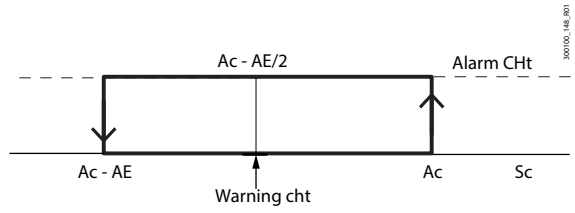


Fig. 9.d

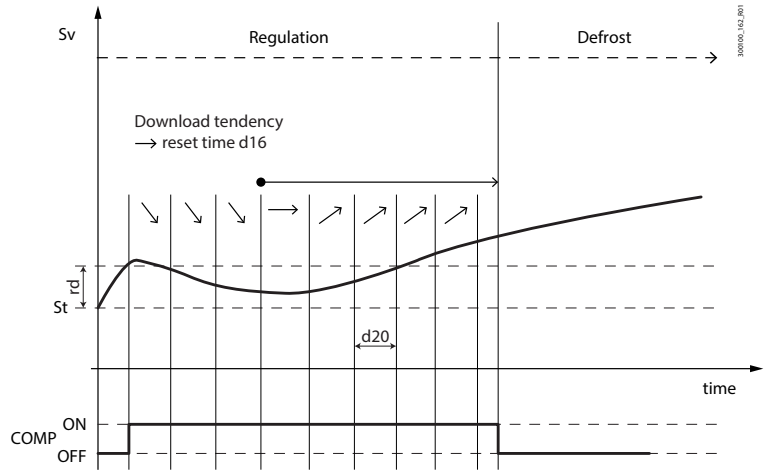
Ref.	Description
Sc	Condensing temperature probe reading
Ac	Dirty condenser alarm threshold
AE	Dirty condenser alarm differential
ACd	Dirty condenser alarm delay
cht	Dirty condenser warning
CHt	Dirty condenser alarm

When the temperature Ac-AE/2 is exceeded, warning cht is generated to signal that the condenser is possibly obstructed. If the temperature subsequently returns below Ac-AE, the warning ceases automatically. If on the other hand the condensing temperature rises above the alarm threshold Ac for a time greater than the value set for parameter Acd, alarm CHt is generated and the compressor is stopped. Alarm CHt is reset manually; this is done
by setting parameter rSA.

9.6 Refrigerant leak alarm rSF

The iJM controller manages an algorithm that checks if the temperature decreases after the compressor is switched on; if the temperature does not decrease sufficiently, the controller attempts to perform a number of defrosts. If even after defrosting the temperature still does not fall, it is assumed that there has been a refrigerant leak and manual-reset alarm rSF is generated, which stops the unit.

Code	Description	Def.	Min	Max	UOM	User	User terminal
d20	Sampling time for alarm rSF	0	0	240	min	M	NO
d16	Time with no temperature decrease before starting defrost	30	Add	240	min	M	NO
d21	Number of defrosts allowed before signalling alarm rSF	2	1	5	-	M	NO
d22	Temperature difference to verify decrease	0.1/0.2	0.1/0.2	0.5/0.9	Δ °C/°F	M	NO



Ref.	Description
Sv	Control probe
St	Control set point
rd	Control differential
d16	Time with no temperature decrease before starting defrosting
d20	Sampling time for alarm rSF
t	Time

Fig. 9.e

After switching on the compressor, the iJM controller checks at the intervals set for d20 that the control temperature falls by at least by the value set for parameter d22; at the end of each interval, if the temperature decreases, the time with no temperature decrease is reset; on the other hand, if the temperature remains constant or increases, the controller starts counting the time with no temperature decrease, and on reaching the threshold set by parameter d16, a defrost is started. This operating cycle is repeated for a maximum number of defrosts set by parameter d21, after which alarm rSF is activated and the unit is switched off. Alarm rSF is reset manually using parameter rSA.

9.7 Maintenance alarm

The iJM 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	Operating hour threshold for maintenance alarm hx1000	0	0	45	hours/1000	M	NO
HMr	Reset operating hours	0	0	1	-	S	YES

If the RTC clock is available and working correctly, the iJM controller can count the number of hours that have elapsed since the last time the operating hours were reset. When the threshold set by parameter HMP is exceeded, the 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.

9.8 VCC compressor alarms with serial control

For VCC compressors with serial control, the iJM controller manages several additional alarms, either detected by the inverter or by the controller itself:

	Description	Message on the display
Detected by the inverter	Failed start-up	UCF
	Overload condition	
	Short circuit	
	Incorrect rotor position	
	Overtemperature	
	Serial communication errors	COM
Detected by the controller	Offline	

Tab. 9.d

Par.	Description	Def	Min	Max	UOM	User	User terminal
CoA	Display alarms detected by the inverter: 0 = display disabled; 1 = display enabled.	1	0	1	-	(**)	NO
Ctd	Maximum VCC inverter communication failure time before alarm is shown on the display (0 = display disabled)	15	0	60	s	(**)	NO

(**) Parameter only available via the configuration tool.

To stop these alarms being shown on the display, set the following parameters:

- CoA = display alarms detected by the inverter; when the inverter detects a VCC malfunction, alarm UCF is shown on the display.
- Ctd = maximum time with no communication before the alarm is shown on the display; when the iJM controller detects no communication with the inverter for a time equal to Ctd, alarm COM is shown on the display.

Notice: to disable the alarms relating to VCC compressors on models with the VCC option yet without the inverter connected, set parameters cct and ctd to zero.

10. LOGS

The iJM controller can record both periodic and event logs, which can then be viewed and downloaded using the Applica app and commissioning tools. To view the logs from Applica, select Service Area -> Trend -> (tab) Logs for the periodic logs, or Service Area -> Trend -> (tab) Events for event logs:

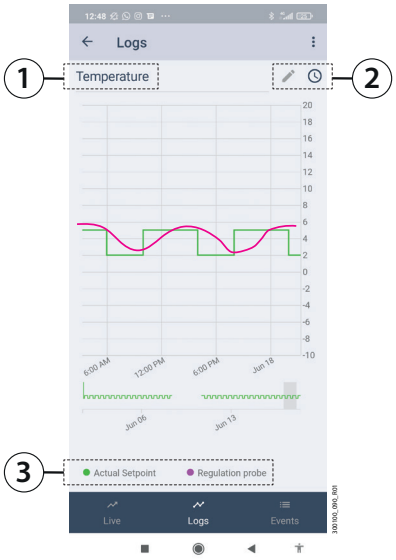


Fig. 10.a

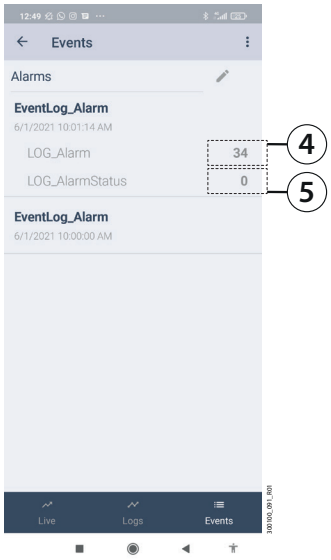


Fig. 10.b

Ref.	Description
1	Preset
2	Periodically logged variables
3	Tools to modify the display
4	Alarm status (0 = not active; 1 = active)
5	Alarm code (see "Alarms")

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

10.1 Periodic logs

The periodic logs record the main values at regular intervals, as shown in the table.

Logged value	UOM	Period
Current temperature set point.	°C/°F	1 h
Control temperature	°C/°F	1 h
Compressor, minutes ON in the period	min	1 h
Compressor, starts in the period	-	1 h
Door, number of long openings in one hour	-	1 h
Door, number of short openings in one hour	-	1 h
Lights, minutes ON in the period	min	1 h

Tab. 10.a

10.2 Event logs

Event logs are recorded when specific conditions occur, and can be used to store certain related values, as shown in the table.

Logged value	Event	Other recorded values	Number of samples (*)	Limits
Alarm	Alarm activation	Number of the active alarm with highest priority. Alarm status (active/ceased)	200	max 255 alarm
Blackout	Device ON	Power failure duration in minutes	600	1000 hours
Set point	Set point variation greater than 0.1 °C/°F	-	200	

Tab. 10.b

(*) The samples are stored in a circular FIFO list (e.g. for the alarms, the 21st alarm overwrites the 1st alarm, and so on).

The type of alarm recorded in the log can be identified using the alarm code (see the Alarm table).

Caution: changing the time set on the iJM controller by more than 140 minutes will clear the stored logs.

10.3 Other recorded values

In addition to the periodic and event logs, the iJM controller can record a number of read-only parameters, such as the number of operating hours of the main devices, certain operating conditions (e.g. defrost) and door openings, as shown in the table.

The values of these variables can be viewed in the Applica app, using the hamburger menu at the top left of the screen, and in the commissioning tools.

Parameter	Description	Parameter	Description
cntCmp	Compressor operating hours (x100)	cntHLVP	Operating hours with HLV (x100)
cntCond	Condenser fan operating hours (x100)	cntLight	Light operating hours (x100)
cntDfr	Defrost activation hours (x100)	cntON	Unit ON hours (x100)
cntDoorL	Number of long door openings (x100)	cntResDoorT	Date and time of the last door opening counter reset
cntDoorS	Number of short door openings (x100)	cntResT	Date and time of the last counter reset
cntEvap	Evaporator fan operating hours (x100)		

Tab. 10.c

Parameters cntRes and cntResDoor are used to reset the operating hour counter of the main devices/functions and the door openings, and to record the date and time of the read-only parameters cntResT and cntResDoorT were reset.

Par.	Description	Def	Min	Max	UOM	User	User terminal
cntRes	Reset counter	0	0	1	-	S	
cntRes-Door	Reset door opening count	0	0	1	-	S	NO

11. APPENDIX

11.1 ir33 and IJ parameter compatibility table

The table below shows the parameters from the Carel PJ and IR33 platforms that have changed name or function in the IJ platform. The parameters not listed in this chapter have retained the same name and the same function.

ir33	iJ	Description	Default	Min	Max	UOM
AF	-	Not present	-	-	-	-
AP	-	Not present	-	-	-	-
Apd	-	Not present	-	-	-	-
H6	-	Not present	-	-	-	-
H9	-	Not present	-	-	-	-
/c1, /c2, /c3, /c4, /c5	/cA	Outlet temperature probe (Sm) calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cb	Defrost temperature probe (Sd) calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cc	Intake temperature probe (Sr) calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cg	Auxiliary temperature probe 1 calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cH	Auxiliary temperature probe 2 calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cI	Room temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/co	Condensing temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/ °F
	/cr	Product temperature probe calibration	0	-20/ -36	20/ 36	Δ °C/ °F
/A2, /A3, /A4, /A5	/FA	Assign outlet temperature probe (Sm) 0 = Function disabled 1 = Probe S1 2 = Probe S2 3 = Probe S3 4, 5 = Reserved 6 = Probe S1H 7 = Reserved	1	0	7	-
	/Fb	Assign defrost temperature probe (Sd) - see /FA	0	0	7	-
	/Fc	Assign intake temperature probe (Sr) - see /FA	0	0	7	-
	/FG	Assign auxiliary temperature probe 1 (Saux1) - see /FA	0	0	7	-
	/FH	Assign auxiliary temperature probe 2 (Saux1) - see /FA	0	0	7	-
	/FI	Assign room temperature probe (SA) - see /FA	0	0	7	-
	/Fo	Assign condensing temperature probe - see /FA	0	0	7	-
	/FR	Assign product temperature probe - see /FA	0	0	7	-
H2	/nE	Enable user terminal navigation: 0 = enabled; 1 = disabled	0	1	1	-
/P	/P1	Configure probe type S1, S2, S3: 0 = PT1000; 1 = PTC; 2 = NTC; 3 = NTC-LT; 4 = NTC-HT.	2	0	4	-
	/P2	Configuration of multifunction input S3/DI1: 0, 1, 2, 3, 4 = S3; 5 = DI1.	5	0	5	-
/tI	/t1	Display on user terminal: 0 = Not configured 1 = Value of S1 2 = Value of S2 3 = Value of S3 4 = Not available 5 = Value of S1H 6 to 8 = Not available 9 = Control probe 10 = Virtual probe 11 to 14 = Not available 15 = Actual control set point	9	0	15	-
A8	A3	Defrost terminated after maximum time signal: 0 = Disabled; 1 = Enabled	30	1	240	min
d8d	Add	High temperature alarm bypass time for door open	5	1	240	min
d9	c7	Defrost priority over continuous cycle: 0 = Continuous cycle has priority; 1 = Defrost has priority	0	0	1	-
cc, cPd	cc	Continuous cycle running time (0 = Disabled)	0	0	72	h
d3	d15	Start defrost threshold	0	0	240	min
d12	d7	Skip defrost: 0 = Disabled; 1 = Enabled	0	0	1	-
A4, A5, A9	DIA	Assign immediate external alarm digital input: 0 = Disabled; 1 = ID1; 2 = ID2; 3 = D1H; 4 = Reserved.	0	0	4	-
	DIb	Assign delayed external alarm digital input - see DIA	0	0	4	-
	DIc	Assign enable defrost digital input - see DIA	0	0	4	-
	DId	Assign start defrost digital input - see DIA	0	0	4	-
	DIE	Assign door switch with compressor OFF digital input - see DIA	0	0	4	-
	DIF	Assign remote ON/OFF digital input - see DIA	0	0	4	-
	DIG	Assign curtain switch digital input - see DIA	0	0	4	-
	DIH	Assign start/stop continuous cycle digital input - see DIA	0	0	4	-
	DIo	Assign working parameter set changeover digital input - see DIA	0	0	4	-
	DIP	Assign door switch without compressor OFF digital input - see DIA	0	0	4	-
	DIS	Assign generic function alarm digital input logic - see DIA	0	0	4	-
	DIt	Assign low pressure switch digital input - see DIA	0	0	4	-
	DIU	Assign AUX output activation digital input - see DIA	0	0	4	-

ir33	iJ	Description	Default	Min	Max	UOM
H1, H5	DOA	Assogn solenoid/compressor digital output 0 = Not configured 1 = Digital output 1 (NO1) 2 = Digital output 2 (NO2) 3 = Digital output 3 (NO3) 4 = Digital output 4 (NO4) 5, 6 = Reserved	1	0	6	-
	DOb	Assign alarm digital output - see DOA	0	0	6	-
	DOC	Assign AUX auxiliary digital output - see DOA	0	0	6	-
	DOE	Assign light digital output - see DOA	4	0	6	-
	DOG	Assign defrost digital output - see DOA	2	0	6	-
	DOI	Assign evaporator fan digital output - see DOA	0	0	6	-
	DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	6	-
	DOS	Assign generic On/Off function digital output - see DOA	0	0	6	-
	DOt	Assign condenser fan digital output - see DOA	0	0	6	-
F5	F5d	Condenser fan activation differential	5/ 9	0.1/ 0.2	60/ 108	°C/°F
Ado	H14	Time light stays on after closing the door	0	0	240	min
H4	Hb	Buzzer: 0 = Disabled; 1 = Enabled	1	0	1	-
Hdn	IS	Configuration to be loaded (0 = no configuration selected)	0	0	...	-
Pw	PDM	Manufacturer password (OEM)	44	0	999	-
	PDS	Service password	22	0	999	-
	PDU	User password	0	0	999	-
r5	rM	Enable temperature monitoring: 0 = Disabled; 1 = Enabled	0	0	1	-
tof_ d_	tE1- d, …, tE8-d	End time band 1 to 8 - day, see (td1...8-d)	0	0	11	-
tof_ h_	tE1-hh, …, tE8-hh	End time band 1 to 8 - hours	0	0	23	hours
tof_m_	tE1-mm, …, tE8- mm	End time band 1 to 8 - minutes	0	0	59	minutes
toF	tE1- time, …, tE8- time	End time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-
ton_d_	tS1- d, …, tS8-d	Start time band 1 to 8 - day, see (td1...8-d)	0	0	11	-
ton_h_	tS1-hh, …, tS8-hh	Start time band 1 to 8 - hours	0	0	23	hours
ton_m__	tS1- mm, …, tS8-mm	Start time band 1 to 8 - minutes	0	0	59	minutes
ton	tS1- time, …, tS8- mm	Start time band 1 to 8 (Applica)	0:00:00	0:00:00	23:59:59	-
-	cuF	Conversion factor from frequency (Hz) to compressor speed (rpm)	30	0	999	rpm *1/ hz

Tab. 11.a

11.2 Input/output configuration procedure

The inputs and outputs can be configured in the Applica app or configuration tool by setting the corresponding parameters.

Fig. 11.a

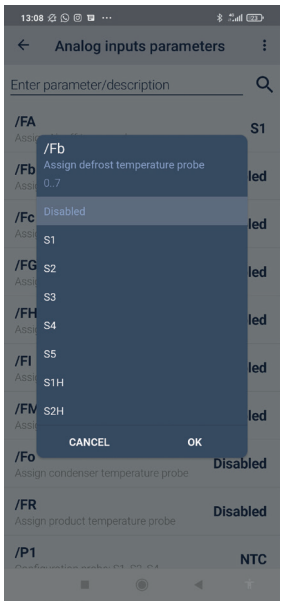


Fig. 11.b

Procedure:

1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth, entering the profile credentials;
3. move the device closer to the iJM to modify the input/output configuration on (NFC connection only);
4. access Service Area-> I/O;
5. Select the Inputs or Outputs tab;
6. Select the modification tool corresponding to the group of inputs/outputs to be modified;
7. Select the parameter corresponding to the function to be added or modified (the example in the figure shows the defrost probe assignment) and set the input/output to be associated with the function; press OK to confirm;
8. Select "Write" from the drop-down menu at the top right, move the device closer to the iJM and tap "Applica" (NFC connection only).

Analogue inputs

Code	Description	Def	Min	Max	UOM	User	User term.
/FA	Assign outlet temperature probe (Sm) 0 = Function disabled 1 = Probe S1 2 = Probe S2 3 = Probe S3 4, 5 = Reserved 6 = Probe S1H 7 = Reserved	1	0	7	-	M	NO
/Fb	Assign defrost temperature probe (Sd) - see /FA	0	0	7	-	M	NO
/Fc	Assign intake temperature probe (Sr) - see /FA	0	0	7	-	M	NO
/FG	Assign auxiliary temperature probe 1 (Saux1) - see /FA	0	0	7	-	M	NO
/FH	Assign auxiliary temperature probe 2 (Saux1) - see /FA	0	0	7	-	M	NO
/FI	Assign room temperature probe (SA) - see /FA	0	0	7	-	M	NO
/Fo	Assign condensing temperature probe - see /FA	0	0	7	-	M	NO
/FR	Assign product temperature probe - see /FA	0	0	7	-	M	NO
/P1	Configure probe type S1, S2, S3: 0 = PT1000; 1 = PTC; 2 = NTC; 3 = NTC-LT; 4 = NTC-HT.	2	0	4	-	S	NO
/P2	Configuration of multifunction input S3/ DI1: 0, 1, 2, 3, 4 = S3; 5 = DI1	5	0	5	-	S	NO

To set the type of probe, use parameter /P1, to set the function of the multifunction input use parameter /P2.

Digital inputs

Code	Description	Def	Min	Max	UOM	User	User term.
DIA	Assign immediate external alarm digital input: 0 = Disabled; 1 = ID1; 2 = ID2; 3 = D1H; 4 = Reserved	0	0	4	-	M	NO
DIb	Assign delayed external alarm digital input - see DIA	0	0	4	-	M	NO
DIc	Assign enable defrost digital input - see DIA	0	0	4	-	M	NO
DId	Assign start defrost digital input - see DIA	0	0	4	-	M	NO
DIE	Assign door switch with compressor OFF - see DIA	0	0	4	-	M	NO
DIF	Assign remote ON/OFF digital input - see DIA	0	0	4	-	M	NO
DIG	Assign curtain switch digital input - see DIA	0	0	4	-	M	NO
DIH	Assign start/stop continuous cycle digital input - see DIA	0	0	4	-	M	NO
DIo	Assign working parameter set changeover digital input - see DIA	0	0	4	-	M	NO
DIP	Assign door switch without compressor OFF digital input - see DIA	0	0	4	-	M	NO
DIS	Assign generic function alarm digital input logic - see DIA	0	0	4	-	M	NO
DIt	Assign low pressure switch digital input - see DIA	0	0	4	-	M	NO
DIU	Assign AUX output activation digital input - see DIA	0	0	4	-	M	NO
/P2	Configuration of multifunction input S3/ DI1: 0, 1, 2, 3, 4 = S3; 5 = DI1	5	0	5	-	S	NO

Analogue outputs

Code	Description	Def	Min	Max	UOM	User	User term.
/AA	Assign analogue output for modulating evaporator fan: 0 = Not configured; 1 = Analogue output 1 (Y1); 2 = Analogue output 2 (Y2).	0	0	2	-	M	NO
/Ad	Assign analogue output for modulating generic function - see /AA	0	0	2	-	M	NO
/AE	Assign analogue output for modulating condenser fan - see /AA	0	0	2	-	M	NO
/AF	Assign analogue output for modulating lights - see /AA	0	0	2	-	M	NO
/AG	Assign analogue output for modulating compressor - see /AA	0	0	2	-	M	NO

Digital outputs

Code	Description	Def	Min	Max	UOM	User	User term.
DOA	Assogn solenoid/compressor digital output 0 = Not configured 1 = digital output 1 (NO1) 2 = digital output 2 (NO2) 3 = digital output 3 (NO3) 4 = digital output 4 (NO4) 5, 6 = Reserved	1	0	6	-	M	NO
DOb	Assign alarm digital output - see DOA	0	0	6	-	M	NO
DOC	Assign AUX auxiliary digital output - see DOA	0	0	6	-	M	NO
DOE	Assign light digital output - see DOA	4	0	6	-	M	NO
DOG	Assign defrost digital output - see DOA	2	0	6	-	M	NO
DOI	Assign evaporator fan digital output - see DOA	3	0	6	-	M	NO
DOk	Assign auxiliary compressor without rotation digital output - see DOA	0	0	6	-	M	NO
DOS	Assign generic On/Off function digital output - see DOA	0	0	6	-	M	NO
DOt	Assign condenser fan digital output - see DOA	0	0	6	-	M	NO

11.3 Set the default parameters/load the parameter sets

The working set contains the group of parameters used by the iJM controller during normal operation. This set is loaded whenever the iJM controller is started, and the parameters can be modified at any time from the terminal, supervisor, Applica app and configuration software. This set of parameters, customised by the user to control their refrigeration system, can be saved in a configuration using Applica. Subsequently the configuration can be retrieved and loaded onto the controller again using Applica.
iJM also stores a default parameter set in its memory; this set can never be overwritten, being stored in a non-modifiable memory area. The default configuration can be loaded to restore the system to factory conditions.
Various parameter configurations can also be loaded into the device's internal memory, and then selected as the working set as desired. A specific parameter can therefore be set to apply the different configurations directly from the terminal or in Applica. The configurations can be created, modified and applied using specific configuration tools distributed by Carel (Spark and Sparkly) or can be loaded during production phase (see "Preparing and using the configurations" for details).

11.3.1 Procedure for setting the default parameters/loading the parameter sets

Par.	Description	Def.	Min.	Max.	UoM
IS	Working configuration	0	0	IS_Max	-
IS_max	Number of embedded configurations	0	0	999	-
rSC	Restore default values	0	0	1	-

User terminal (see "User interface" for details)

Procedure:
1. unlock the keypad by holding the PROGRAM button for 3 s;
2. access the parameter setting menu by pressing the PROGRAM button;
3. use the UP and DOWN buttons to scroll the submenus until selecting "Ctl";
4. use the UP and DOWN buttons to scroll the parameters until selecting "rSC" to restore the Carel default values, or "IS" to load one of the parameter sets available on the controller;
5. to reset the parameters to the default values, after having selected parameter "rSC", press UP/DOWN to set the value 1 and confirm by pressing PROGRAM;
6. to load one of the parameter sets available on the controller, after selecting parameter "IS", press UP/DOWN to choose the value corresponding to the parameter set to be loaded as the working set, and confirm by pressing PROGRAM.

Applica

Procedure:
1. open Applica on the smartphone;
2. access the controller via NFC or Bluetooth, entering your profile credentials;
3. scroll to parameter "rSC" (if enabled in the access profile) to restore the Carel default values, or "IS" to load one of the parameter sets available on the controller;
4. set parameter "rSC" or "IS" and confirm.

Notice: the visibility of parameters "rSC" and "IS" depends on the access profile used and whether or not there are any preloaded configurations, respectively.

Applying a configuration means copying the set values of the configuration parameters to the working parameters. Any empty parameters (parameters without values set in that configuration) will remain unaffected. The copy procedure is started by changing the value of parameter IS.
Once the configuration has been applied, the value of any of the parameters can be modified without affecting the configuration loaded on the controller, which can thus be recalled at any time, firstly setting the corresponding parameter to 0 and then to the value associated with the desired configuration.

Notice:
- the parameters contained in a configuration cannot be modified in any way.
- Any parameters that are not included in the configuration will remain unchanged, even if the configuration used is changed.
- Recalling the factory parameters resets the settings without however changing the configurations.

11.4 Copy configuration parameters

To simplify operations in the field, Applica includes a "Clone" feature to acquire the configuration from one iJM and replicate it on other controllers.

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

Notice: cloning copies all of the parameters, even those not visible to the user based on the access profile. On the other hand, to copy only the parameters that are visible to the user, use the "Create configuration" option, accessible from Service Area -> Setup -> Parameter list.

11.5 Prepare and use the configurations

A configuration is a set of code-value pairs that can contain all, some, or just one parameter.
Example: configuration "1":
rd = 3
St = 2.5
dI = 10
d0 = 1

Notice: it is strongly recommended for all configurations to contain the same parameters, to avoid any parameter setting errors that may cause alarms or malfunctions.

The following procedure describes how to create the configurations, load them onto the controller and recall them using the tools described under "Configuration tools".

11.5.1 Create configurations

Spark is the tool used to create configurations.

Procedure:
1. open Spark;
2. open the workspace provided by Carel (unique for each software version)
3. select the "Configurations" tab;
4. select "New configuration" and enter the configuration name, which must be a progressive number;
5. in the parameter list, enter the values corresponding to the parameters to be included in the configuration in the "Configuration value" column;

Notice: the configuration name must be a progressive number, with the following format: 1, 2, 3 … n, other names or non-consecutive values are not allowed.

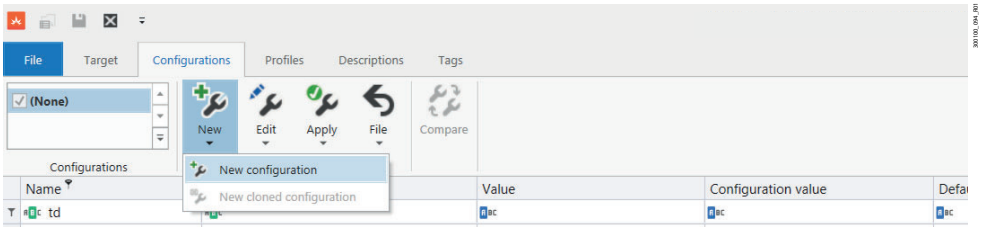


Fig. 11.c

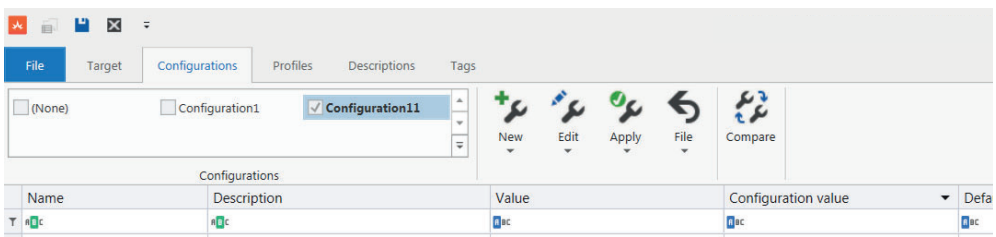


Fig. 11.d

Instlling the configurations

Sparkly is the tool used to install configurations on iJM.

Procedure:

1. create a folder on the PC or laptop (C:\Temp);
2. create configurations using Spark and save them in the folder created previously;
3. save the .pack file containing the iJM software version supplied by Carel in the same folder (e.g. HQ000IJF000B0.pack);
4. run Sparkly and write the following command: pack- file embed - - src "C:\Temp\HQ000IJM000B0.pack" - - configurations "C:\Temp\1.stconfiguration""C:\Temp\2.stconfiguration""C:\Temp\n.stconfiguration"
5. Press "Enter".

Notice: the configurations must be named with progressive numbers (1.stconfiguration, 2.stconfiguration, etc.). All of the configurations must be entered, no skipped or missing numbers are allowed.

The new .pack file containing the configurations will be generated in the folder and is ready to be installed on the controller.

"Auto-start" configuration

When the .pack file containing the configurations has been created, the configuration that iJM will use at power-on (auto-start) can be selected, rather than using parameter IS (see "Selecting a configuration") by simply adding the configuration name to the end of the string.

Example: the command pack- file embed - src "C:\Temp\HQ000IJM000B0_ 1_ 1_ 0.pack" - - configurations "C:\Temp\1.stconfiguration""C:\Temp\2.stconfiguration" - - auto- start "2" will create a .pack file with the second configuration as auto-start.

Installing configurations via BMS using the CVSTDUMOR0 converter

To install the new .pack file containing the configurations on the iJM controller, run Sparkly and write the following command: app download - - src "HQ000IJM000B0.pack" - - connection Serial,COM4,1152008N2,1 - - working directory "C:\Temp", where COMx is the COM port the converter is connected to, and then press "Enter". Where:

- HQ000IJM000B0: is the name of the .pack file containing the configurations; if modified, it must be replaced by the name of the new .pack file generated using Sparkly;
- COM4: this must be replaced with the COM port used for connection to iJM;
- 115200: the serial communication speed must correspond to the value of parameter H10 on iJM; recommended value at 115200 bps (H10 = 7) for faster loading;
- C:\Temp: is the folder containing the files described above;
- 1: must be replaced with the device's serial address (parameter H0, factory set to 1)

Installing configurations via digital input ID2 using the BXOPZIOWD0000 converter

To install the new .pack file containing the configurations on the iJM controller, run Sparkly and write the following command to enable digital input ID2 as a serial port on iJM: device enable-serial-on-ID --port COMx --interval 30 and then power on the controller.
From this point on the commands are the same as those used via BMS.

Notice: the serial communication speed for ID2 is fixed at 57600 bps, regardless of the value set for H10.

12. RELEASE NOTES

The software version is shown for a few seconds when the controllers with user interface are switched on (first two digits only), via the BMS variable or Applica app.
The correspondence between the software version and the manual version is shown below.

Software version	Manual version	Description
1.1.0	1.0 15/07/2022	First release

NOTES:

NOTES:

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