EV3B94 Controller for DHW heat pump heaters

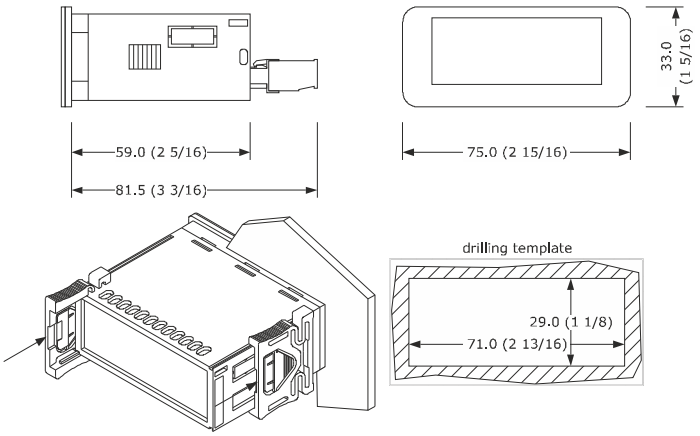
PLEASE READ CAREFULLY and save this document
CONSIDER THE ENVIRONMENT

EN ENGLISH

- power supply 115... 230 VAC
- DHW tank upper and lower probe, evaporator probe (PTC/NTC/Pt 1000)
- photovoltaic, HP and multi-purpose digital input (see i0)
- compressor relay 16 A res. @ 250 VAC
- alarm buzzer.

1 MEASUREMENTS AND INSTALLATION

Measurements in mm (inches). To be fitted to a panel, snap-in brackets provided.

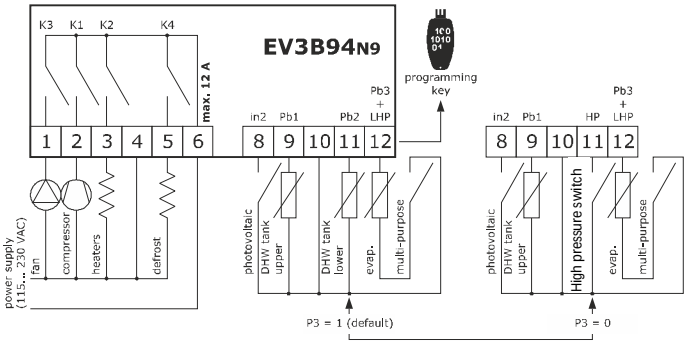


INSTALLATION PRECAUTIONS

- the thickness of the panel must be between 0.8 and 2.0 mm (1/32 and 1/16 in);
- ensure that the working conditions are within the limits stated in the *TECHNICAL SPECIFICATIONS* section;
- do not install the device close to heat sources, equipment with a strong magnetic field, in places subject to direct sunlight, rain, damp, excessive dust, mechanical vibrations or shocks;
- in compliance with safety regulations, the device must be installed properly to ensure adequate protection from contact with electrical parts. All protective parts must be fixed in such a way as to need the aid of a tool to remove them.

2 ELECTRICAL CONNECTION

N.B.
- use cables of an adequate section for the current running through them.
- to reduce any electromagnetic interference locate the power cables as far away as possible from the signal cables.



PRECAUTIONS FOR ELECTRICAL CONNECTION

- if using an electrical or pneumatic screwdriver, adjust the tightening torque;
- if the device is moved from a cold to a warm place, humidity may cause condensation to form inside. Wait for about an hour before switching on the power;
- make sure that the supply voltage, electrical frequency and power are within the set limits. See the section *TECHNICAL SPECIFICATIONS*;
- disconnect the power supply before carrying out any type of maintenance;
- do not use the device as a safety device;
- for repairs and for further information, contact the EVCO sales network.

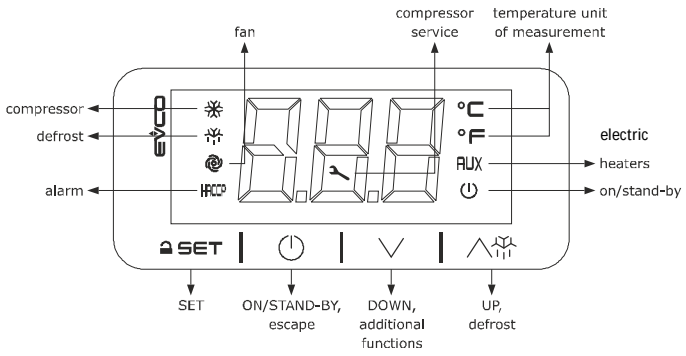
3 FIRST-TIME USE

1. Carry out the installation following the instructions given in the section *MEASUREMENTS AND INSTALLATION*.
2. Power up the device as set out in the section *ELECTRICAL CONNECTION*: an internal test will start up.
   The test normally takes a few seconds; when it is finished the display will switch off.
3. Configure the device as shown in the section *Setting configuration parameters*.
   Recommended configuration parameters for first-time use:

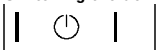
PAR.	DEF.	PARAMETER	MIN... MAX.
SP1	**55.0**	setpoint in economy mode	r3... r4
SP2	**65.0**	setpoint in comfort mode	r1... r2
P0	**1**	type of probe	0 = PTC 1 = NTC 2 = Pt 1000
P2	**0**	temperature measurement unit	0 = °C 1 = °F
P3	**1**	enabled probes	0 = DHW tank upper probe + high pressure input 1 = DHW tank upper and lower probe
d1	**2**	type of defrost	0 = electric 1 = hot gas 2 = compressor stopped 3 = hot gas balancing the pressure

   Then check that the remaining settings are appropriate; see the section *CONFIGURATION PARAMETERS*.
4. Disconnect the device from the mains.
5. Make the electrical connection as shown in the section *ELECTRICAL CONNECTION* without powering up the device.
6. Power up the device.

4 USER INTERFACE AND MAIN FUNCTIONS



4.1 Switching the device on / off

1.		Touch the ON/STAND-BY key for 4 s.

If the device is switched on, the display will show the P5 value ("DHW tank upper temperature" default); if the display shows an alarm code, see the section ALARMS.

LED	ON	OFF	FLASHING
	compressor switched on	compressor switched off	- compressor protection active - setpoint being set
	- defrost active	-	-
	fans switched on	fans switched off	-
HACCP	alarm active	-	-
	compressor maintenance request	-	-
°C / °F	temperature display	-	-
AUX	heaters switched on	heaters switched off	-
	device switched off	device switched on	-

When 30s have elapsed without the keys being pressed, the display will show the "**Loc**" label and the keypad will lock automatically.

4.2 Unlocking the keypad

Touch a key for 1 s: the display will show the label "**UnL**".

4.3 Setting the setpoint Economy

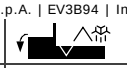
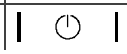
Check that the keypad is not locked.

1.		Touch the SET key: the display will show the label "**SP1**".
2.		Touch the SET key.
3.		Touch the UP or DOWN keys within 15s to set the value within the limits r3 and r4 (default "40... 55").
4.		Touch the SET key (or take no action for 15s).
5.		Touch the ON/STAND-BY key.

4.4 Setting the Comfort setpoint

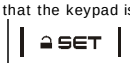
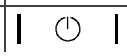
Check that the keypad is not locked.

1.		Touch the SET key: the display will show the label "**SP1**".

2.		Touch the UP or DOWN key to select the label "**SP2**".
3.		Touch the SET key.
4.		Touch the UP or DOWN keys within 15s to set the value within the limits r1 and r2 (default "40... 70").
5.		Touch the SET key (or take no action for 15s).
6.		Touch the ON/STAND-BY key.

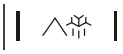
4.5 Setting the overboost activation threshold

Check that the keypad is not locked.

1.		Touch the SET key: the display will show the label "**SP1**".
2.		Touch the UP or DOWN key to select the label "**SP3**".
3.		Touch the SET key.
4.		Touch the UP or DOWN keys within 15s to set the value within the limits 10 and r2 (default "10... 70").
5.		Touch the SET key (or take no action for 15s).
6.		Touch the ON/STAND-BY key.

4.6 Activating manual defrost

Check that the keypad isn't locked and that the anti-legionella and overboost functions aren't active.

1.		Touch the UP key for 4s.

If P4 = 1 or 2 (default), defrost is activated provided that the evaporator temperature is lower than the d2 threshold.

4.7 Silencing the alarm buzzer (if u9 = 1)

Touch a key.

5 FUNCTIONS AND LOAD OPERATIONS

5.1 Economy

- compressor on if DHW tank lower temperature < "SP1 setpoint - r0 differential" and off if DHW tank lower temperature > "SP1 setpoint"
- fans on if compressor on
- heaters switched off in normal operation (on if needed during defrost)

5.2 Comfort

- compressor on if DHW tank lower temperature < "SP5 setpoint - r0 differential" and off if DHW tank lower temperature > "SP5 setpoint"
- fans on if compressor on
- heaters on, with a single probe configured (P3 = 0), if DHW tank upper temperature < "SP2 - r6 threshold - r7 differential" and off if DHW tank upper temperature > "SP2 - r6 threshold".
- heaters on, with two probes configured (P3 = 1), if DHW tank upper temperature < "SP2 – r0 differential" and off if DHW tank upper temperature > "SP2".

5.3 Anti-legionella

It activates at "H0 intervals", provided that DHW tank lower temperature > "SP1 setpoint" and > "SP2 setpoint"

- compressor switched off
- fans switched off
- heaters switched on until DHW tank upper temperature > "H1 threshold" and then for "H3 time".

5.4 Overboost

It activates in manual mode, provided that DHW tank upper and lower temperature < "SP3 threshold"

- compressor, fans and heaters on until DHW tank upper temperature > "SP1 setpoint".

5.5 Defrosting

It activates with evaporator temperature < "d17 threshold" for "d18 time" or in manual mode, provided that the anti-legionella and overboost functions are not active

- compressor switched on if d1 = 1
- defrost relay active if d1 = 1 or 2
- fans switched on if d1 = 2
- heaters switched on to prevent too high temperature drop in the storage tank

5.6 Photovoltaic system

It activates with photovoltaic input active

- operation as in comfort mode, except for "SP2 setpoint" which becomes "SP6 setpoint".

5.7 Green

It activates with multi-purpose input active and DHW tank upper and lower temperature > "SP8 setpoint"

- compressor switched off
- fans switched off
- heaters switched off.

5.8 Antifreeze

This function is used to prevent the water freezing. It is activated when tank upper temperature < "SP7 setpoint" – "r0 differential" and this function is deactivated when tank upper temperature > "SP7 setpoint"

- heaters are switched on.

This function can be active only if the controller is in stand-by.

5.9 Pre opening hot gas defrost valve

This function is used to balance the pressure at the compressor start-up, and it is activated only if "d1" = 3.

This function switch on the defrost output "i11" seconds before the start-up of the compressor, this occurs every time the compressor started, even if there is no defrost request.

5.10 Fan operation

The fan operates depending on the active function, normally C12 second before the switch on of the compressor. There are some exceptions:

- defrost: in case of hot gas (d1=1) compressor is active but fan is off. In case of compressor stop (d1=2) compressor is off but fan is active
- alarms: in case of LHP compressor is off but fan is active.

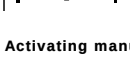
6 ADDITIONAL FUNCTIONS

6.1 Activating / deactivating comfort operation in manual mode

Check that the keypad is not locked.

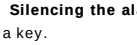
1.		Touch the DOWN key for 1 s: the display will show a code.
2.		Touch the UP or DOWN key within 15s to select a label.

COD.	DESCRIPTION
Auto	activates comfort operation
ECO	deactivates comfort operation

3.		Touch the SET key.
4.		Touch the ON/STAND-BY key (or take no action for 60s) to exit the procedure.

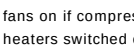
6.1 Activating the overboost function

Check that the keypad isn't locked.

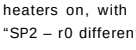
1.		Touch the DOWN key for 1 s: the display will show a code.
2.		Touch the UP or DOWN key within 15s to select "**ObS**".
3.		Touch the SET key.
4.		Touch the ON/STAND-BY key (or take no action for 60s) to exit the procedure.

6.2 Displaying the operating mode

Check that the keypad is not locked.

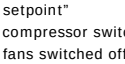
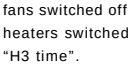
1.		Touch the DOWN key: the display will show a code.

COD.	DESCRIPTION
ECO	economy
ObS	overboost
Auto	comfort
Anti	anti-legionella; if flashing, DHW tank lower temperature > "SP1 setpoint" and > "SP2 setpoint"
dEFr	defrost
in2	photovoltaic function

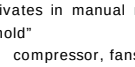
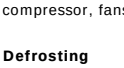
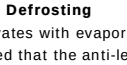
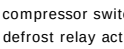
2.		Touch the ON/STAND-BY key (or take no action for 60s) to exit the procedure.

6.3 Displaying / deleting compressor functioning hours

Check that the keypad is not locked.

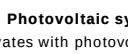
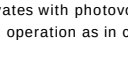
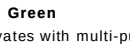
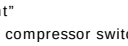
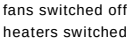
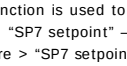
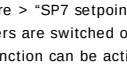
1.		Touch the DOWN key for 1 s: the display will show a code.
2.		Touch the UP or DOWN key within 15s to select a label.

COD.	DESCRIPTION
CH	display compressor working hours in hundreds
rCH	delete compressor working hours

3.		Touch the SET key.
4.		Touch the UP or DOWN key to set "149" (to select **rCH**).
5.		Touch the SET key.
6.		Touch the ON/STAND-BY key (or take no action for 60s) to exit the procedure.

7 SETTINGS

7.1 Setting configuration parameters

1.		Touch the SET key for 4 s: the display will show the label "**PA**".
2.		Touch the SET key.
3.		Touch the UP or DOWN key within 15s to set the PAS value (default "**-19**").
4.		Touch the SET key (or take no action for 15s): the display will show the label "**SP**".
5.		Touch the UP or DOWN key to select a parameter.
6.		Touch the SET key.
7.		Touch the UP or DOWN key within 15s to set the value.
8.		Touch the SET key (or take no action for 15s).
9.		Touch the SET key for 4s (or take no action for 60s) to exit the procedure.

7.2 Restoring factory settings (default)

N.B.
- check that the factory settings are appropriate; see the section *CONFIGURATION PARAMETERS*.

1.	SET	Touch the SET key for 4 s: the display will show the label "**PA**".
2.	SET	Touch the SET key.
3.		Touch the UP or DOWN key within 15s to set "**149**".
4.	SET	Touch the SET key (or take no action for 15s): the display will show the label "**dEF**".
5.	SET	Touch the SET key.
6.		Touch the UP or DOWN key within 15s to set "**1**".
7.	SET	Touch the SET key (or take no action for 15 s): the display will show "**- - -**" flashing for 4 s, after which the device will exit the procedure.
8.	Disconnect the device from the power supply.	
9.	SET	Touch the SET key for 1s before action 6 to exit the procedure beforehand.

7 CONFIGURATION PARAMETERS

No.	PAR.	DEF.	SETPOINT	MIN... MAX.
1	SP1	**55.0**	setpoint in economy mode	r3... r4
2	SP2	**65.0**	setpoint in comfort mode	r1... r2
3	SP3	**45.0**	overboost activation threshold	10 °C/°F... r2
4	SP5	**55.0**	heat pump switch-off threshold	r1... SP2
5	SP6	**75.0**	photovoltaic system setpoint	40... 100 °C/°F
6	SP7	**5.0**	setpoint in antifreeze mode	0... 40 °C/°F
7	SP8	**40.0**	setpoint in green mode	0... 100 °C/°F
8	SP9	**-7.0**	cold evaporator alarm threshold	-25... 25 °C/°F
9	SPA	**-25**	evaporator failure alarm threshold	-50... 25 °C/°F

No.	PAR.	DEF.	ANALOGUE INPUTS	MIN... MAX.
10	CA1	**0.0**	DHW tank upper probe offset	-25... 25 °C/°F
11	CA2	**0.0**	DHW tank lower probe offset	-25... 25 °C/°F
12	CA3	**0.0**	evaporator probe offset	-25... 25 °C/°F
13	P0	**1**	type of probe	0 = PTC 1 = NTC 2 = Pt 1000
14	P1	**1**	enable decimal point °C	0 = no 1 = yes
15	P2	**0**	temperature measurement unit	0 = °C 1 = °F
16	P3	**1**	enabled probes	0 = DHW tank upper probe + high pressure input 1 = DHW tank upper and lower probe
17	P4	**2**	evaporator probe function	0 = disabled (defrost every d18 minutes) 1 = defrost activation and defrost end 2 = defrost activation
18	P5	**0**	value displayed	0 = DHW tank upper temperature 1 = setpoint in comfort mode 2 = DHW tank lower temperature 3 = evaporator temperature
19	P8	**5**	display refresh time	0... 250 s: 10

No.	PAR.	DEF.	REGULATION	MIN... MAX.
20	r0	**3.0**	setpoint differential	1... 30 °C/°F
21	r1	**40.0**	minimum setpoint in comfort mode	10 °C/°F... r2
22	r2	**70.0**	maximum setpoint in comfort mode	r1... 100 °C/°F
23	r3	**40.0**	minimum setpoint in economy mode	10 °C/°F... r4
24	r4	**55.0**	maximum setpoint in economy mode	r3... 100 °C/°F
25	r5	**0**	enable setpoint blocking in economy and comfort modes	0 = no 1 = yes
26	r6	**15.0**	heater threshold in comfort mode	0... 50 °C/°F
27	r7	**15.0**	heater threshold differential in comfort mode	1... 30 °C/°F

No.	PAR.	DEF.	COMPRESSOR	MIN... MAX.
28	C0	**5**	compressor on delay from power-on	0... 240 min
29	C1	**5**	minimum time between two power-ons of compressor	0... 240 min
30	C2	**5**	minimum compressor-off time	0... 240 min
31	C3	**0**	minimum compressor-on time	0... 240 s
32	C10	**400**	compressor hours for maintenance	0... 999 h x 100 0 = disabled
33	C11	**120**	interval for cold evaporator control	0... 999 min
34	C12	**60**	compressor-on delay from fan on for cold evaporator control	0... 240 s
35	C13	**20**	compressor-on delay from green multi-purpose input reset	0... 240 min
36	C14	**20**	compressor-on consecutive time for evaporator failure control	-1... 240 min -1 = disabled

No.	PAR.	DEF.	DEFROST	MIN... MAX.
37	d1	**2**	type of defrost	0 = electric 1 = hot gas 2 = compressor stopped 3 = hot gas balancing the pressure
38	d2	**3.0**	defrost end threshold	-50... 50 °C/°F
39	d3	**30**	defrost duration	0... 99 min 0 = defrost disabled If P4 = 1, maximum duration default 0 in map 3 of EV3B94N9PXRX01 and EV3B94N9VXRX01
40	d17	**-2.0**	evaporation threshold for defrost interval count	-50... 50 °C/°F
41	d18	**30**	defrost interval	0... 240 min 0 = manual only

No.	PAR.	DEF.	ALARMS	MIN... MAX.
42	A0	**0**	select value for low temperature alarm	0 = DHW tank upper temperature 1 = DHW tank lower temperature 2 = evaporator temperature
43	A1	**10.0**	low temperature alarm threshold	0... 50 °C/°F
44	A2	**0**	low temperature alarm type	0 = disabled 1 = absolute
45	A3	**0**	select value for high temperature alarm	0 = DHW tank upper temperature 1 = DHW tank lower temperature 2 = evaporator temperature
46	A4	**90.0**	high temperature alarm threshold	0... 199 °C/°F default 75.0 in EV3B94N9PXRX01 and EV3B94N9VXRX01
47	A5	**0**	high temperature alarm type	0 = disabled 1 = absolute
48	A6	**120**	high temperature alarm delay from power-on	0... 240 min
49	A7	**15**	high/low temperature alarm delay	0... 240 min
50	A11	**2.0**	high/low temperature alarm reset differential	1... 30 °C/°F

No.	PAR.	DEF.	FAN	MIN... MAX.
51	F0	**1**	enable fan	0 = no 1 = yes

No.	PAR.	DEF.	ANTI-LEGIONELLA	MIN... MAX.
52	H0	**30**	anti-legionella interval	0... 99 d (days) 0 = none
53	H1	**70.0**	anti-legionella thermal threshold	10... 199 °C/°F
54	H3	**2**	anti-legionella thermal threshold maintenance duration	0... 240 min 0 = function disabled

No.	PAR.	DEF.	DIGITAL INPUTS	MIN... MAX.
55	i0	**0**	multi-purpose input function	0 = disabled 1 = pressure switch 2 = green
56	i2	**0**	compressor-on delay from pressure switch alarm reset	0... 120 min
57	i3	**0**	enable photovoltaic system	0 = no 1 = yes
58	i4	**1**	photovoltaic system input activation	0 = with contact closed 1 = with contact open
59	i5	**1**	high pressure input activation	0 = with contact closed 1 = with contact open
60	i8	**3**	number of pressure switch alarms for unit blocked alarm	0... 15 0 = disabled
61	i9	**240**	counter reset time for pressure switch alarms	1... 999 min
62	i10	**24**	pressure switch alarm delay from compressor-on	0... 240 sx10
63	i11	**60**	time pre opening hot gas defrost valve	0... 240 s
64	i12	**0**	fan off during pressure switch/unit blocked alarm	0 = no 1 = yes default 1 in EV3B94N9PXRX01 and EV3B94N9VXRX01

No.	PAR.	DEF.	DIGITAL OUTPUTS	MIN... MAX.
65	u0	**1**	enable relay K2 and relay K4 inversion	0 = no (defrost on K2) 1 = yes (defrost on K4)
65	u9	**1**	enable alarm buzzer	0 = no 1 = yes

9 ALARMS

CODE	DESCRIPTION	RESET	TO CORRECT
Pr1	DHW tank upper probe alarm	automatic	- check P0 - check probe integrity - check electrical connection
Pr2	DHW tank lower probe alarm	automatic	

Pr3	evaporator probe alarm	automatic	
AL	low temperature alarm	automatic	check A0, A1 and A2
AH	high temperature alarm	automatic	check A3, A4 and A5
LHP	pressure switch/unit blocked alarm	automatic/ manual	- switch the device off and on - check i0, i8 and i9
HP	high pressure alarm	manual	- switch the device off and on - check P3
FiL	compressor maintenance alarm	automatic	check C10 by silencing the buzzer you delete the compressor functioning hours
UtL	evaporator failure alarm	manual	- switch the device off and on - check SPA and C14

10 TECHNICAL SPECIFICATIONS

Purpose of the control device		function controller
Construction of the control device		built-in electronic device
Container		black, self-extinguishing.
Category of heat and fire resistance		D.
Measurements		
75.0 x 33.0 x 59.0 mm (2 15/16 x 1 5/16 x 2 5/16 in) with fixed screw terminal blocks		75.0 x 33.0 x 81.5 mm (2 15/16 x 1 5/16 x 3 3/16 in) with plug-in screw terminal blocks
Mounting methods for the control device		to be fitted to a panel, snap-in brackets provided
Degree of protection provided by the covering		IP65 (front)
Connection method		
fixed screw terminal blocks for wires up to 2.5 mm²		plug-in screw terminal blocks for wires up to 2.5 mm² (on request).
Maximum permitted length for connection cables		
power supply: 10 m (32.8 ft)		analogue inputs: 10 m (32.8 ft)
digital inputs: 10 m (32.8 ft)		digital outputs: 10 m (32.8 ft).
Operating temperature		From 0 to 55 °C (from 32 to 131 °F)
Storage temperature		from -25 to 70 °C (from -13 to 158 °F)
Operating humidity		relative humidity without condensate from 10 to 90%
Pollution status of the control device		2.
Compliance:		
RoHS 2011/65/EC	WEEE 2012/19/EU	REACH (EC) Regulation no. 1907/2006
EMC 2014/30/EU		LVD 2014/35/EU
Classification of the control device according to protection from electrical shock		class II according to standard EMC EN 60730-1 §2.7.5.
Power supply		115... 230 VAC (+10% -15%), 50/60 Hz (±3 Hz), max. 3.2 VA insulated
Earthing methods for the control device		none
Rated impulse-withstand voltage		2.5 KV
Over-voltage category		II.
Software class and structure		A.
Analogue inputs		2 for PTC, NTC or Pt 1000 probes (DHW tank upper probe and evaporator probe)
PTC probes	Sensor type:	KTY 81-121 (990 Ω @ 25 °C, 77 °F)
	Measurement field:	from -50 to 150 °C (from -58 to 302 °F)
	Resolution:	0.1 °C (1 °F).
NTC probes	Sensor type:	ß3435 (10 K□Ω @ 25 °C, 77 °F)
	Measurement field:	from -40 to 105 °C (from -40 to 221 °F)
	Resolution:	0.1 °C (1 °F).
Pt 1000 probes	Measurement field:	from -100 to 650 °C (from -148 to 999 °F)
	Resolution:	0.1 °C (1 °F).
Digital inputs		2 dry contact (photovoltaic and multi-purpose input)
Dry contact	Contact type:	5 VDC, 1.5 mA
	Power supply:	none
	Protection:	none.
Other inputs	can be configured for analogue input (DHW tank lower probe) or for digital input (high pressure input)	
Digital outputs	4 with electro-mechanical relay (compressor, defrost, fans and heaters)	
Compressor relay (K1)		SPST, 16 A res. @ 250 VAC
Relay K2		SPST, 8 A res. @ 250 VAC
Fan relay (K3)		SPST, 5 A res. @ 250 VAC
Relay K4		SPST, 5 A res. @ 250 VAC
Type 1 or Type 2 Actions		Type 1
Additional features of Type 1 or Type 2 actions		C.
Displays		custom display, 3 digit, with function icons
Alarm buzzer		Built-in

N.B.
The device must be disposed of according to local regulations governing the collection of electrical and electronic equipment.

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