XW05K - XW07K – CX40

ELECTRONIC CONTROLLER FOR

AIR CONDITIONERS

REL. 19.5e

Summary

1. UPDATES TO SOFTWARE VERSION 19.5D DATED 15.01.2020

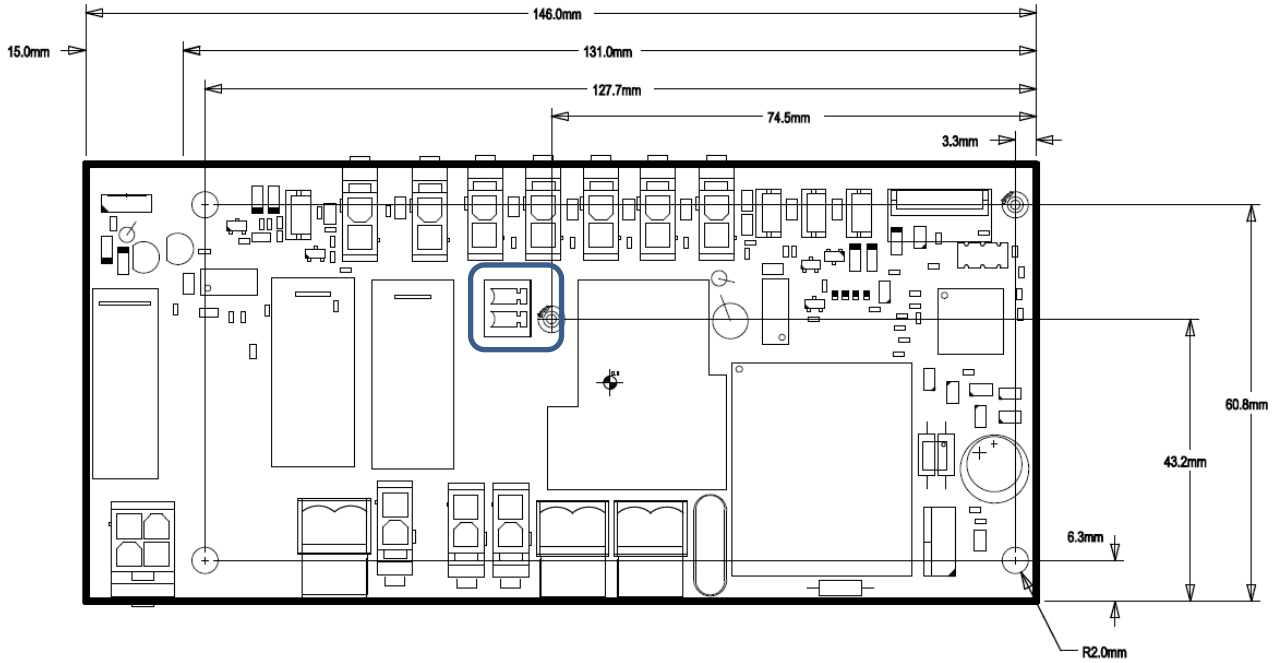
1. Chap. 21.4 Hot gas bypass

2. UPDATES TO SOFTWARE VERSION 19.5 DATED 07.10.2019

1. Chap. 13 Wiring diagrams K1 → K1A and K1B
2. Chap. 18: relay capacities

3. UPDATES TO VERSION 19.5 DATED 2018.

1. Chap.14
   Notes on installation
2. Chap. 15

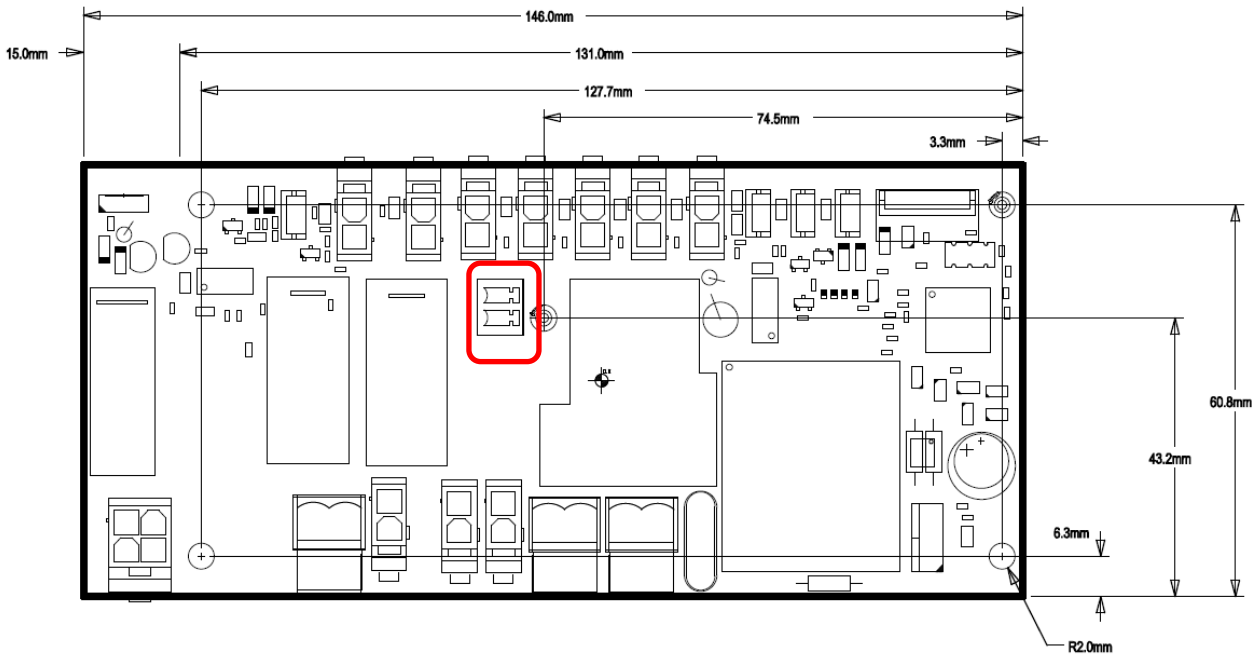



Modified type of connector

2. Chap. 20

4. UPDATES TO SOFTWARE VERSION 17.9 DATED 31.03.2017

1. Chap. 14 HW



The new digital input must cut the compressor relay coil.
This digital input is called HP_C

2. Chap. 15.1 Dimensions and fastening holes
3. Chap. 24.6 HP Digital input

5. UPDATES TO SOFTWARE VERSION R15.1 DATED 20.06.2017

1. Chap. 13*PARAMETER TABLE*
2. Chap. 21.2 *Cooling with compressor*
3. Chap. 24.3 *Temperature*

6. UPDATES TO SOFTWARE VERSION R12.3 DATED 2015.02.11

1. Chap. 13*PARAMETER TABLE*
2. Chap.21.1 *COMPRESSOR ACTIVATION DELAY*
3. Chap. 21.5 *VARIABLES COMPRESSOR MANAGEMENT*
4. Chap. 21.7 *K1 relay management*
5. Chap. 24.1 *ALARM MANAGEMENT WITH DIFFERENT MACHINE STATUSES*
6. Chap. 24.15 *ALARM IN OFF STATUS*
7. Chap. 24.16 *STAND-BY / WINTER STAND-BY STATUS ALARM*
8. Chap. 24.17 *TABLE WITH THE ALARM CODES*
9. Chap. 24.17 *TABLE WITH THE ALARM CODES*

7. UPDATES TO SOFTWARE VERSION R2.0 2014.07.24

1. Chap. 7 Meaning of the keys
2. Chap. 13*PARAMETER TABLE*
3. Chap. 14 CONNECTION DIAGRAM
4. Chap. 19 Technical specifications
5. Chap. 23 Machine statuses
6. Chap. 24 Alarms
7. Chap. 25Sequencing

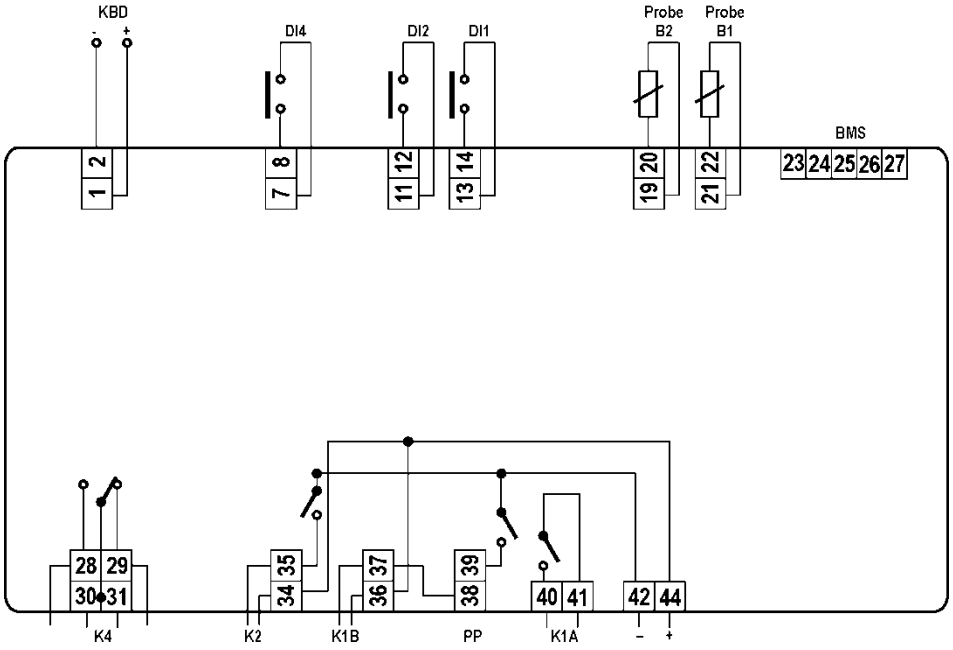
8. UPDATES TO SOFTWARE VERSION R1.0 2014.05.26

1. Chap. 14 CONNECTION DIAGRAM
2. Chap.19 Technical specifications

9. UPDATES TO SOFTWARE VERSION DATED 2014.03.28

1. Chap. 11.2 Meaning of the keys
2. Chap. 12.9 Manual reset after locking alarms

9.1 Chap. 14.1 XW05K, 14.2 XW05K – POWER SUPPLY 48VDC



Key -

a. Short circuit terminal PP (38-39) to enable relay K1B (36-37)

b. Power supply 36-59Vdc; 42 (-) 44 (+)

NOTES: (+) on terminals 34, 36

(-) on terminals 35, 37, 39

c. K1B(36-37), K2: 3FLA/6LRA, 48Vdc

d. K1A (40-41): max 0.5A max 24V

3. XW07K
4. Chap. 24 Alarms
5. Chap. 26 Testing mode

10. GENERAL DESCRIPTION

Electronic controller **XW07K** and the relative **CX40** keyboard are designed for applications on air conditioners.
The tool is to be incorporated into the final machine and neither can be used on its own
XW07K has 4 relay outputs to control the compressor and condenser fans, heating elements, evaporator/pump fans, respectively. The fourth relay is used to report alarms.
The tool has up to 3 probes to control the ambient, evaporator and condenser temperature.
The 4.20mA input is used to control the supply pressure.
Moreover, it has 3 potential-free digital inputs that can be set via a parameter.
A fourth digital input can be used to synchronise 2 units.

The instrument has HOTKEYS that make it easy to program
The TTL serial output is used to interface the device with the monitoring and supervision systems.

11. USER INTERFACE

11.1 CX40 keyboard

11.2 Meaning of the keys

SET	(**SET**) To view or edit the setpoint. In programming mode, it selects a parameter or confirms a value.
∧	(**UP**) • In programming mode, it scrolls through the parameter codes or increases their value. • Quick menu access • If the programming key is inserted, the UPLOAD procedure for data from the device to the pen drive is activated.
∨	(**DOWN**) In programming mode, it scrolls through the parameter codes or decreases their value **If pressed for 3s**, it is used for the MANUAL UNLOCK function when the machine is locked due to: • Machine lock due to LOW PRESSURE (at least 4 events in 3 hours) • Machine lock due to FLOW Errors (at least 4 events in 3 hours) • Machine lock for HIGH suction TEMPERATURE alarm
⏻	**(ON/OFF)** Turns the instrument on and off, if the onF parameter = oFF.

11.3 Key combinations

∧ + ∨	To lock or unlock the keyboard.
SET + ∨	To go into programming mode. **In parameter programming mode**: level Pr2 is used to change the visibility of the displayed parameter in level Pr1. If the decimal point is on while the parameter's label is displayed, this means that the parameter is visible in programming level Pr1.
SET + ∧	To exit programming.

11.4 Meaning of the LEDs

There is a series of dots on the display. Their meaning is described in the table

LED	MODE	MEANING
❄	On	Compressor(s) on
❄	Flashing	Delay against close start-ups
	On	Evaporator fans active
	Flashing	Delay of evaporator fans start-up in progress
	On	An alarm occurred
	On	Saven in progress
	Flashing	Saven II in progress
AUX	On	Heating element on
AUX	Flashing	Delay of heating element start-up in progress
°C/°F	On	Unit of measurement
°C/°F	Flashing	- Programming
	On	During the sequencing: device in MASTER mode (Adjustment active)
	Flashing	During the sequencing: device in SLAVE mode (Additional adjustment)

12. MAIN FUNCTIONS

12.1 DISPLAY QUICK MENU

The device is used to rapidly access the display of special resources used in the various settings.
Here is the list of resources:

1. Probe B1 value
2. Probe B2 value
3. Probe B3 value
4. Probe B4 value
5. Analogue output AO1 value
6. Analogue output AO2 value
7. Status of 1st digital input (nu , OFF , ON)
8. Status of 2nd digital input (nu , OFF , ON)
9. Status of 3rd digital input (nu , OFF , ON)
10. Status of 4th digital input (nu , OFF , ON)

12.1.1 How to use the quick display menu

To go to the menu:

1. Press UP, when released the display will show the first label of the menu: dP1 (display probe 1)
2. To scan through the list, press UP to go down, or DOWN to go up.
3. Here are the list labels that will appear while you do this:
    a. dP1 (Probe B1)
    b. dP2 (Probe B2)
    c. dP3 (Probe B3)
    d. dP4 (Probe B4)
    e. AO1 (1st Analogue Output)
    f. AO2 (2nd Analogue Output)
    g. In1 (1st Digital Input)
    h. In2 (2nd Digital Input)
    i. In3 (3rd Digital Input)
    j. In4 (4th Digital Input)
4. Press SET to display the corresponding value of the resource.
5. Press SET to go back to scanning through the list.

NOTE 1: The following can be displayed for probes B1, B2, B3:

- a temperature value expressed in Celsius or Fahrenheit degrees
- the flashing "**Err**" label to indicate that there is a probe failure
- the "**nu**" (not used) label to indicate that the probe is not enabled (B2,B3 = no)

NOTE2: The following can be displayed for probe B4:

- a pressure value expressed in bar or PSI
- the flashing "Err" label to indicate that there is a probe failure
- the "nu" (not used) label to indicate that the probe is not enabled (B4 = no)

NOTE3: The following can be displayed for analogue outputs AO1 and AO2:

- a percentage value from 0 to 100 that expresses the value coming out from the resource
- the "nu" (not used) label to indicate that the analogue output is not used by any function (AO1/AO2 = nu)

NOTE4: With regard to the state of the digital inputs, the following can be displayed:

- the "OFF" label if the input is not enabled; the "On" label if the input is enabled.
- the “nu” (not used) label to indicate that the digital input is not used by any function (i1F, i2F, i3F i4F = nu).

12.2 How to display the setpoint

1) Press and release the **SET** key: the set point will be immediately displayed.
2) To go back to displaying the temperature, wait for 5 seconds or press **SET** again.

12.3 Modifying the Setpoint

1) Press the **SET** key for at least 2s.
2) The set point will be displayed, and the **°C** LED will start flashing.
3) To edit the value use the keys **o** and **n.**
4) To memorise the new set point press the **SET** key or wait for 15 sec to exit programming.

12.4 Changing the value of a parameter

Change the value of a parameter, proceed as follows:
1) Access the programming mode, hold down **SET**+**n** for a few seconds. (The °**C** LED flashes)
2) Select the desired parameter.
3) Press SET to display the value
4) Change it with the **o** and **n** keys.
5) Press SET to save the new value and go to the next parameter.

Exit: Press **SET+ o** when a parameter is displayed or wait 15s without pressing any key.
NOTE: the new set value is also saved when you exit without pressing SET.

12.5 The hidden menu

The hidden menu includes all the instrument parameters.

HOW TO ACCESS THE HIDDEN MENU
1) Access programming by pressing Set + **n** for 3s (the **°C** LED flashes).
2) When displaying a parameter hold the Set + **n** keys for at least 7s. The “Pr2” message will be displayed immediately followed by the “Hy” parameter. **YOU ARE NOW IN THE HIDDEN MENU.**
3) Select the desired parameter.
4) Press SET to display the value.
5) Change it with the **o** and **n** keys.
6) Press SET to save the new value and go to the code of the next parameter.

Exit: Press **SET+ o** when a parameter is displayed or wait 15s without pressing any key.
NOTE: the new set value is also saved when you exit without pressing SET.

12.6 How to move a parameter from the hidden menu on the first level and vice versa.

Each parameter in the Hidden menu can be removed or entered into the "FIRST LEVEL" (user level) by pressing **SET**+ **n**.
If a parameter is in the "FIRST LEVEL" when you are in the "Hidden menu" the decimal point is on.

12.7 How to lock the keyboard

1. Hold down the **o** and **n** keys for a few seconds, until "POF" starts to flash.
2. At this point, the keyboard is locked: you can only view the set point of the maximum and minimum temperature,
3. If a key is pressed for more than 3s, "POF" appears.

12.8 Unlocking the keyboard

Hold down the **o** and **n** keys for a few seconds, until "POn" starts to flash.

12.9 Manual reset after locking alarms

In the event of a machine lock due to
- a LOW PRESSURE alarm (at least 4 events in 3 hours)
- a FLOW Error alarm (at least 4 events in 3 hours)

Press the ARROW DOWN key for 4 seconds to reset the machine.

12.10 The On/Off function

With "**onF = oFF**", by pressing **ON/OFF** the instrument is set to stand-by mode and displays **"OFF"**.
In this configuration, the loads and all the adjustments are disabled.
Press the key again to set the instrument back to ON.
CAUTION The loads connected to the relays' normally closed contacts keep on operating even when the instrument is in stand-by mode.

13. PARAMETER TABLE

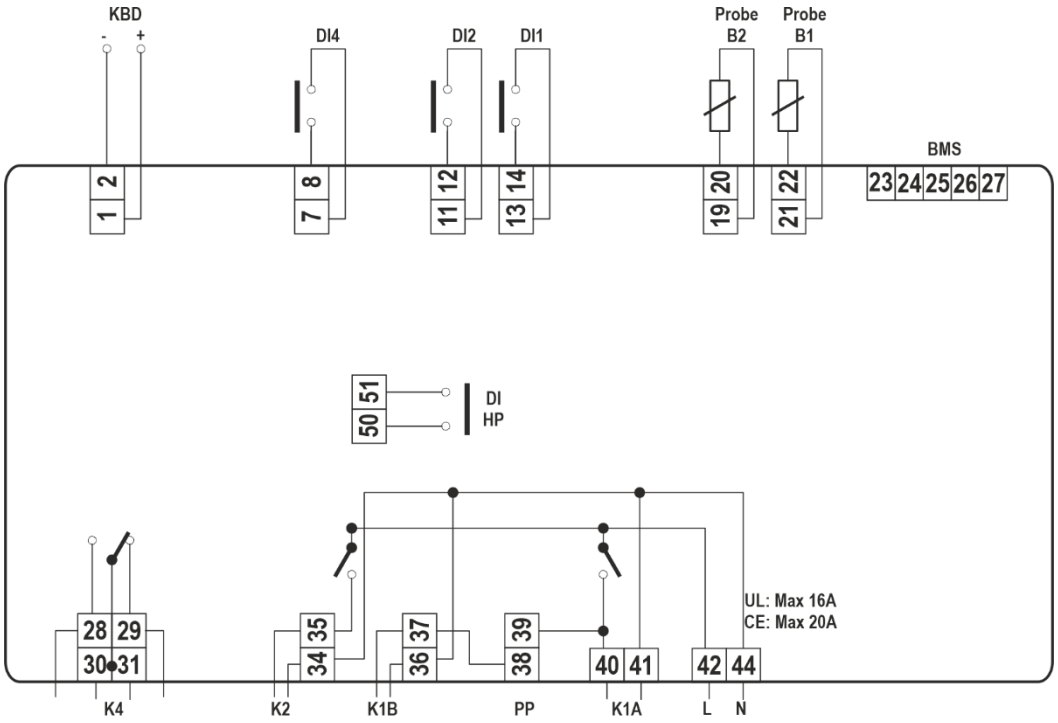
Label	Parameter description	Limits
MM	Main machine	no(0) - yES(1)
Mot	Machine active maximum time	0 - 255 (hours)
MSH	Differential for machine in stand-by	°C[Hy ÷ 25.5] °F[Hy ÷ 45]
Set	Adjustment setpoint	[LS ÷ US]
LS	Lower setpoint limit	°C[-40.0 ÷ SEt] °F[-40 ÷ SEt]
US	Upper setpoint limit	°C[Set ÷ 110.0] °F[Set ÷ 230]
HY	Hysteresis / Proportional band (AO2=CPr)	°C[0.1- 25.5] °F[1 - 45]
ACP	Compressor start-up delay upon power-on	0 - 15 (min.)
Int	Integral part for analogue output 2 with AO2 = CPS	0 - 255 (sec)
CMt	Temperature control mode (Absolute/External T°)	AbS(0) - EtP(1)
LFi	Lower operating limit	°C[-40.0 ÷ LFS] °F[-40 ÷ LFS]
LFS	Upper operating limit	°C[LFi ÷ 110.0] °F[LFi ÷ 230]
CPi	Minimum output value Ao2 = CPS	0÷CPM
CPM	Minimum output value Ao2 = CPS	CPi ÷100
AC	Anti-short cycle delay (switch-off - start-up)	0 - 50 (min.)
OtC	Compressor on minimum time	0 - 15 (min)
OiC	Time between 2 compressor start-ups	0 - 15 (min)
The	Heater regulator enabling	no(0) - yES(1)
SHE	HEATER regulator setpoint	(CMt=AbS) °C[LSH ÷ USH/SEt] °F[LSH + USH/SEt] (CMt=EtP) °C[LSH ÷ USH/LFi] °F[LSH + USH/LFi]
LSH	HEATER lower setpoint limit	°C [-40.0°C ÷ SEH] °F [-40°F ÷ SEH]
USH	HEATER upper setpoint limit	°C[SEH ÷ 110.0] °F[SEH ÷ 230]
HYH	HEATER regulator differential	°C[0.1 - 25.5] °F[1 - 45]
FCM	Fans/Pump: control mode	on(0) - SE(1) - SE2(2)
FUE	Fans/Pump: Winter stand-by mode enabling	no(0) - yES(1)
Fdi	Fans/Pump: Inhibition delta	°C[0.0 - 25.5] °F[0 - 50]
Fdr	Fans/Pump: Reactivation delta	°C[0.0 - 25.5] °F[0 - 50]
Fti	Fans/Pump: Inhibition time	0 - 99 (min.)
Ftr	Fans/Pump: Reactivation time	0 - 99 (min.)
FFd	Fans/Pump: Switch-off delay	0 - 99 (min.)
CF	Temperature unit of measurement: Celsius, Fahrenheit	°C(0) - °F(1)
rES	Resolution (only for T in °C): decimal , integer	dE(0) - in(1)
PMU	Unit of measurement of the Pressure	bAr(0) - PSI(1)
Lod	Display probe selection by default	b1(0) - b2(1) - b3(2)
OF1	Calibration probe (ntc) P1	°C[-12.0 to 12.0] °F[-21 to 21]
b2	P2 probe presence (Evaporator temperature)	nu(0) - EUt(1)
OF2	Calibration probe (ntc) P2	°C[-12.0 to 12.0] °F[-21 to 21]
b3	Probe presence (ntc) P3	nu(0) - CCt (1) - EtP (2) - SUt (3)
OF3	Probe P3 calibration	°C[-12.0 to 12.0] °F[-21 to 21]
b4	Probe presence (mA) P4	nu(0) - CnP(1)
OF4	Calibration probe P4	bar[-12.0 to 12.0] PSI[-21 to 21]
LCi	Pressure probe scale start	[-1.0 bar] [-15 PSI] ÷ UCi

UCi	Pressure probe scale end	LCi ÷ [68.9 bar] [999 PSI]
i1F	Digital input 1 function	nu(0) - OFF(1) - USb(2) - LP(3)
i1P	Digital input 1 polarity	OP(0) - CL(1)
i2F*	Digital input 2 function	nu(0) - HP(1)
i2P*	Digital input 2 polarity	OP(0) - CL(1)
i3F	Digital input 3 function	nu(0) - FL(1) - SF(2)
i3P	Digital input 3 polarity	OP(0) - CL(1)
AO1	Analogue output 1 function (Condenser Fan : T/P)	nu(0) - CFt(1) - CFP(2)
AO2	Analogue output 2 function	nu(0) - HGb(1) - CPS(2)
AT2	Analogue output 2 voltage selection	10u(0) – 5u(1)
HGO	Offset Hot Gas bypass	°C[0.0-25.5] °F[0-45]
HGd	Hot Gas bypass differential	°C[0.0-25.5] °F[0-45]
HGi	Hot Gas bypass Integral Time	0 - 255 (sec)
HGC	Cycle time for Hot Gas bypass	5 - 99 (sec)
HGt	CPR switch-off delay for Hot Gas bypass function active	0 - 9.5(59) (min.10sec)
StC	Condensation set point	°C[-40.0 to 110.0] °F[-40 to 230] BAR[LCi ÷ UCi] PSI[LCi ÷ UCi]
HYC	Condensation hysteresis / Proportional band (AO1)	°C[0.1 - 25.5] °F[1 - 45] BAR[0.1 - 17.0] PSI[1 - 247]
Cin	Condensation PI integral time	0 - 255 (sec)
CSP	Condenser fans percentage at start-up	0 - 100 (%)
CSt	Condenser fans start-up time	0 - 99 (sec)
CHP	Condenser on time with HP alarm	0 - 9.5(59) (min.10sec)
ALS	Status of the control to display the alarms and relative relay	0= Unit **ON** 1= Unit **ON**, **OFF** from keyboard 2= Unit **ON**, **Stand-by / Winter stand-by** only from the digital input 3= Unit **ON**, **OFF** and **Stand-by / Winter stand-by** from the digital input
ALC	Alarm configuration: relative / absolute	AbS(0) - rEL(1)
ALL	Low temperature alarm	°C[0.0 - 40.0 or ALL - 110.0] °F[0 - 90 or ALL - 230]
ALU	High temperature alarm	°C[0.0 - 40.0 or -40.0 - ALU] °F[0 - 90 or -40 - ALU]
HLA	Low temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
HHA	High temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
ALd	Temperature alarm delay (in normal mode)	0 - 99 (min.)
dAo	Temperature alarm exclusion at power on	0 - 9.5(59) (hours.10m)
ALG	Low Anti-freeze alarm	°C[-40.0 to 110.0] °F[-40 to 230]
HYG	Differential for Low Anti-freeze alarm	°C[0.1 -1 25.5] °F[1 - 45]
APd	Low pressure alarm delay	0 - 99 (min.)
FAO	Power fan flow alarm exclusion.	0 - 255 (sec.)
FAd	Flow alarm delay	0 - 255 (sec.)
OPC	ON-OFF key enabling	no(0) - yES(1)
HAS	High suction temperature alarm	-40.0 to 110.0°C // -40 to 230°F
HHS	High suction temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
dHA	Exclusion of the high suction alarm upon compressor start-up	0.0(0) - 40.0 (240) min; resolution 10 seconds
AOP	Alarm output polarity	OP(0) - CL(1)
tbA	Silencing the Alarm	no(0) - yES(1)
Adr	Serial Address	0 - 247
AdO	Stand-by status alarm	no(0) - yES(1)
AoU	OFF status alarm	no(0) - yES(1)
rEL	Firmware release code (read only)	read only
Ptb	EEPROM map identification	read only

* Hidden at the moment

14. CONNECTION DIAGRAM

14.1 XW05K – POWER SUPPLY 115V OPP. 230V

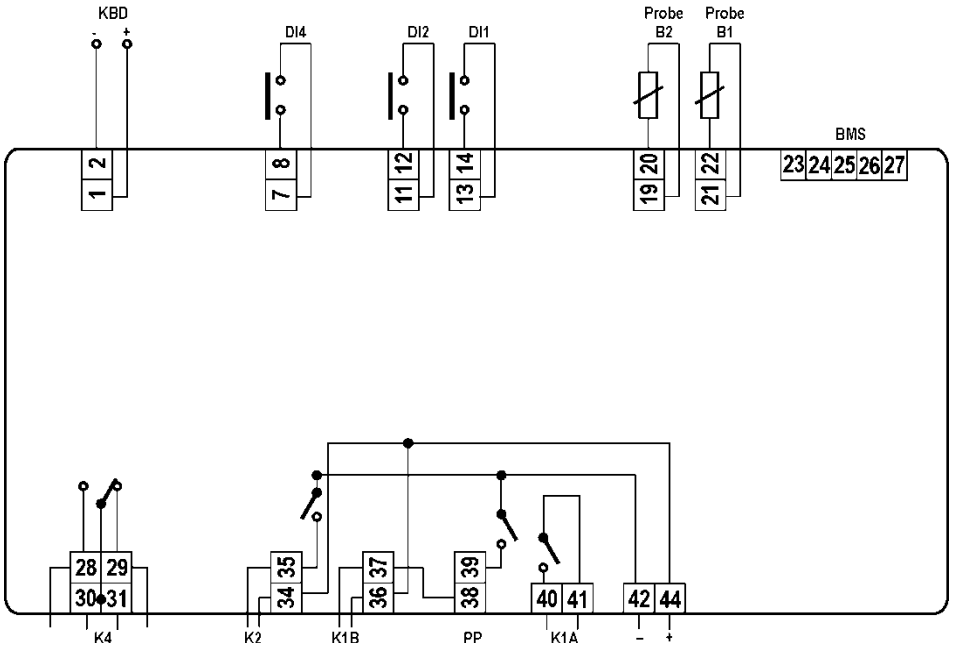


Legenda
a. Short circuit PP (38-39) contacts to enable K1B contacts (36-37)

Terminals 42-44:
- **max 16A according to UL 60730**
- **max 20A according to IEC/EN 60730**

In accordance with IEC/EN60730 and UL60730, use a fuse on the power supply line suitable for the connected loads

14.2 XW05K – POWER SUPPLY 48VDC



Key -
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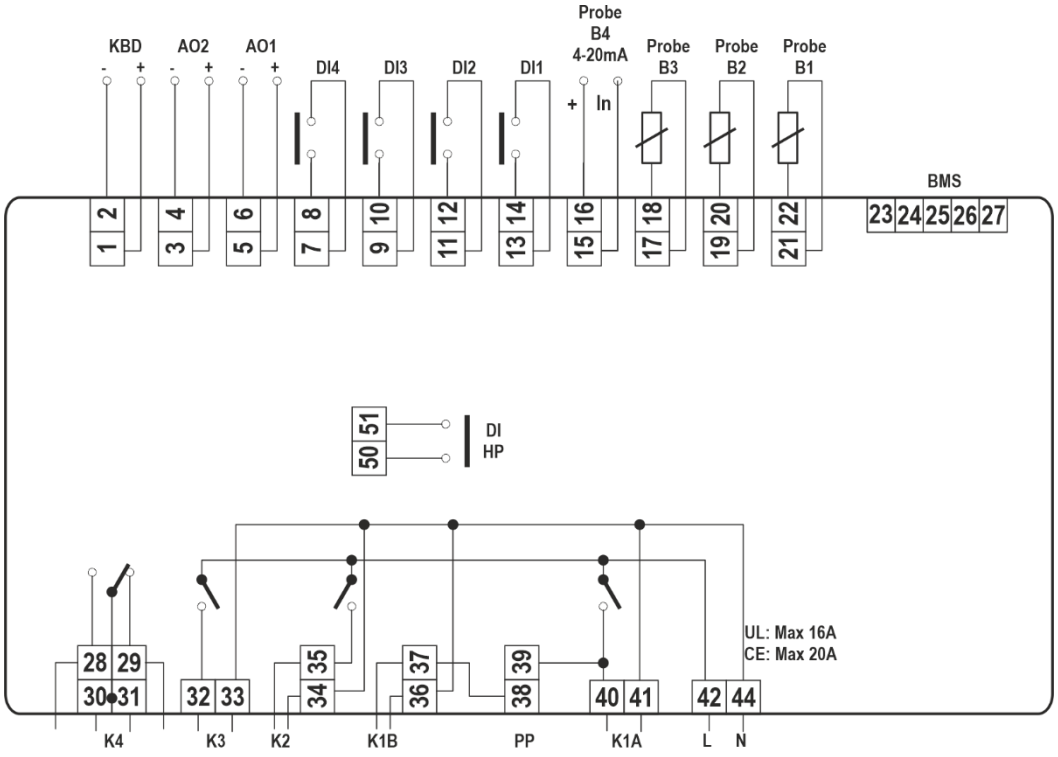
b. Power supply 36-59Vdc; 42 (-) 44 (+)
NOTES: (+) on terminals 34, 36
(-) on terminals 35, 37, 39

c. K1B(36-37), K2: 3FLA/6LRA, 48Vdc
d. K1A (40-41): max 0.5A max 24V

14.3 XW07K – POWER SUPPLY 115V OPP. 230V



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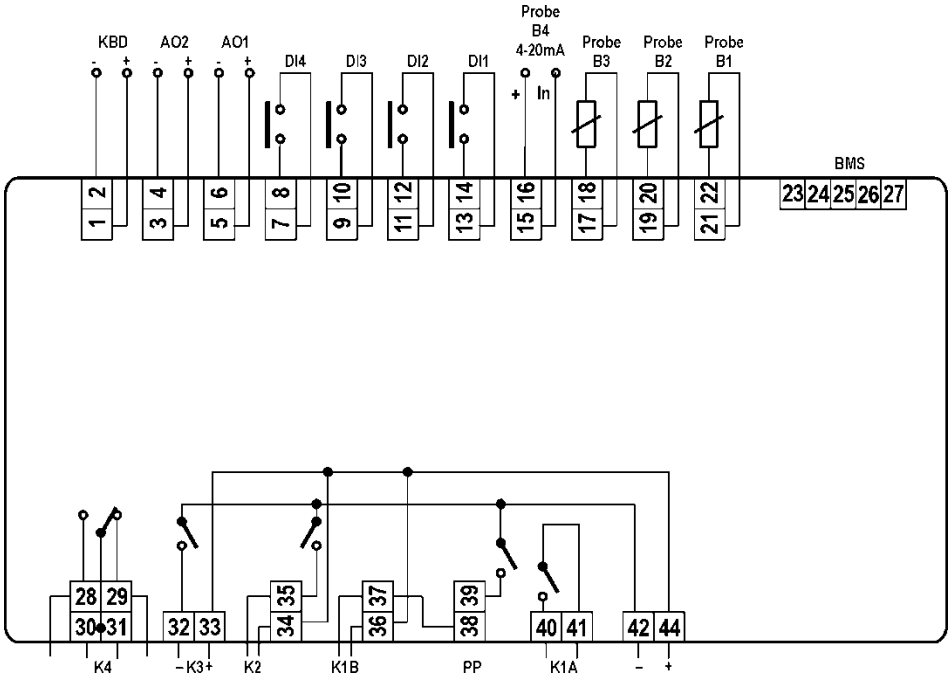
14.4 XW07K – POWER SUPPLY 48Vdc



Key -
a. Short circuit terminal PP (38-39) to enable relay K1B (36-37)
b. Power supply 36-59Vdc: 42 (-) 44 (+)
NOTES: (+) on terminals 33, 34, 36
(-) on terminals 32, 35, 37, 39
c. K1B(36-37), K2: 3FLA/6LRA, 48Vdc
d. K1A (40-41): max 0.5A max 24V
d. K3 (32-33): Resistive; 48V dc, 3A, 30K cycles

15. INSTALLATION AND MOUNTING

The **CX40 keyboard** must be mounted on a vertical panel, in a 29x71 mm hole, and secured with the special support supplied, as shown in figure 1.

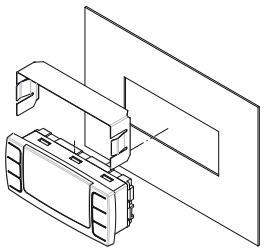


Figure 1a

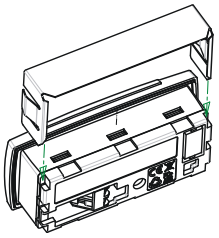


Figure 1b

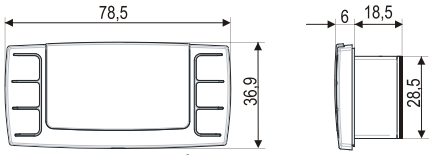
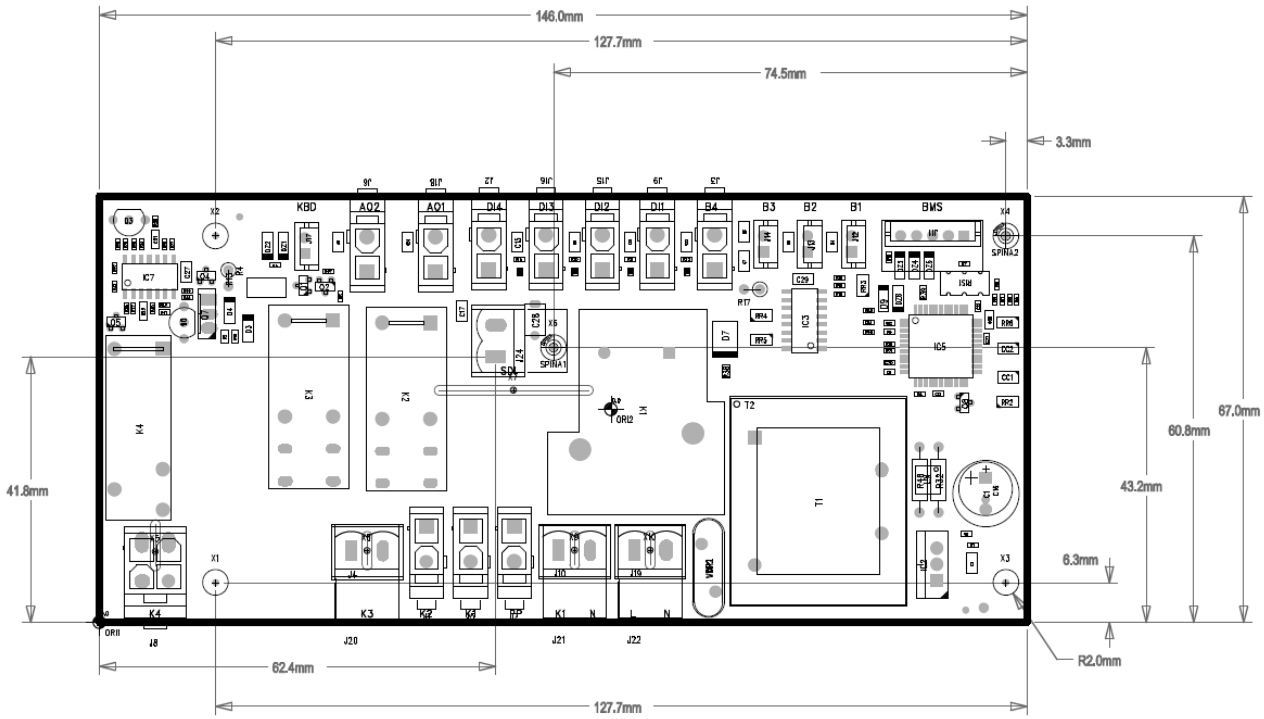


Figure 1c

The **XW05K/XW07K** controller must be mounted by using fastening columns with a max diameter of 3.9 mm, which are inserted into the holes as specified in the next chapter.
Use plastic columns or other insulating material.
Keep a suitable distance from the surrounding structure to ensure its insulation and correct operation.

Avoid places subject to heavy vibration, corrosive gases or excessive dirt or moisture. The same applies to the probes as well. Ensure ventilation in the area near the cooling vents.

15.1 XW05K/XW07K dimensions and fastening holes



16. WIRING CONNECTIONS

The section of the instrument dedicated to the connection of the keyboard is equipped with digital inputs and quick-release connector probes, such as:

- minifit 2-pole
- JST 2-pole
- Plug-in terminal pitch 5.0 mm, 2-way for d.i. HP (BLACK)

The connections are a plug-in type for the connection of all other inputs, the power supply and all the relays. Use heat-resistant wires.
Before connecting the cables, make sure that the power supply voltage conforms to that of the instrument.
Separate the probe connection cables from the power supply cables, from the outputs and the power connections.
Do not exceed the maximum current allowed on each relay; refer to the technical data and in case of heavier loads use a remote switch of adequate power.
N.B. The maximum total current on the loads shall not exceed 16A.

16.1 Probes and digital inputs

It is recommended to place the **thermostat probe** away from direct air flows to measure the average temperature correctly.
The maximum distance allowed for probes and digital inputs, excluding digital input HP, is 10m.
The maximum distance allowed for the HP digital input, is 3m.

17. TTL/RS485 SERIAL LINE

The TTL serial line, available through the **HOT-KEY** connector, allows for interfacing with a compatible monitoring system **ModBUS-RTU**, such as X-WEB500/3000/300 by means of the TTL/RS485 **XJ485-CX** external module.
The entire parameter list can be uploaded and downloaded using the same serial output by means of the "**HOT-KEY**" programming stick.

18. PROGRAMMING KEY

18.1 PROGRAMMING THE KEY

1. Program the instrument with the desired values.
2. Insert the key with the **instrument on** and then press the **UP** key. The programming operation of the key is launched. "**uPL**" flashes on the display
3. At the end the instrument displays the following for 10s:
   - **"End":** programming was successful.
   - **"Err":** programming was not successful. Press the **UP** key to restart programming.

18.2 Programming the instrument with the key.

To program the instrument with a **previously programmed** key proceed as follows:
1. Turn off the instrument or set it in stand-by mode from the keyboard.
2. Insert the programmed key.
3. Turn the instrument on: the automatic data download begins (**DOWNLOAD**) **from** the key **to** the instrument. "**doL**" flashes on the display
4. At the end the instrument displays the following for 10s:
   - **"End":** if programming was successful and the setting restarts.
   - **"Err":** if programming was not successful. At this point repeat the operation or remove the key to start with the normal setting.

19. TECHNICAL SPECIFICATIONS

Keyboards
Housing: Self-extinguishing PC-ABS.
Format: front 75x36 mm; depth 23mm.
Mounting: panel-mounted on a hole measuring 71x29 mm.
Protection rating: IP20.
Front protection rating: IP65.
Connections: plug-in terminal block for conductors ≤ 2.5 mm^2.
Power supply: from **XW07K**.
Display: 3 keys, blue LED, height 14.2mm.
Optional output: Buzzer.

Power module XW07K

Board dimensions: 146x60.8 mm.
Connections:
Probes: B1, B2, B3 JST terminals, 2-pole
Probe: B4, 2-pole Minifit terminals
Digital inputs: ID1, ID2, ID3, ID4 Minifit terminals, 2-pole
Digital input: Plug-in terminal HP pitch 5mm, 2-pole
Analogue outputs 0-10Vdc: Minifit terminals, 2-pole
Keyboard output: JST terminals, 2-pole

TTL output: BMS JST terminals, 5-pole
Power supply and K1, K3 relay: plug-in terminals CPM type Stelvio 2-way for each load
K2, K4 relay: 2-pole Minifit terminals

Power supply: depending on the model: 230Vac ± 10%. 50/60Hz opp. 110Vac ± 10%. 50/60Hz opp. 36-59Vdc
Power consumption: 10VA max.
Resistive probe inputs: 3 probe NTC 10K ±1% ß=3435
Current input: 1 transducer 4-20mA, minimum voltage supplied by XW07K 8Vdc
Maximum distance for the probes: 10m
Configurable digital inputs ID1, ID2, ID3, ID4: voltage free contacts
HP digital input: voltage free contacts
Maximum distance for the digital inputs ID1, ID2, ID3, ID4: 10m
Maximum distance for the HP digital input: 3m
Outputs on relay: ***total current circulating on the MAX 16A UL60730 loads, 20A for IEC/EN60730***

VERSION A 230V or 115V

Compressor + Evaporator fans, K1A+K1B:
K1A+K1B: relay SPST 16FLA – 96A LRA, 250Vac, 30000 cycles
Max: K1B: relay SPST 7A, 250Vac, 30000 cycles
UL 60730:K1A: relay SPST 8FLA – 48A LRA, 250Vac, 100000 cycles
UL 60730:K1B: relay SPST 4FLA – 24A LRA, 250Vac, 100000 cycles

Evaporator fans/ Pump, K2:
relay SPST, 8A FLA – 12A LRA, 250Vac 30000 cycles
UL 60730: relay SPST, 4A FLA – 24A LRA, 250Vac 30000 cycles

Electrical resistors, K3:
relay SPST, 15A, 250Vac, 30000 cycles
UL 60730: relay SPST,14A, 250Vac, 30000 cycles

Alarm, K4:
relay SPDT, 8A - 2FLA 250Vac, 10000 cycles
UL 60730: relay SPDT, 2A 250Vac, 30000 cycles

The following configurations have been tested and approved according to **UL60730**

	Power supply (42-44)	K1A (40-41)	K1B (36-37)	K2 (34-35)	K3 (32-33)	K4 (30/31-28NA)
TEST 1 – Cooling	16 A	8 A	4A	4 A	--	2 A
TEST 2 - heating	16 A	-	-	2 A	14A	2 A

VERSION AT 48Vdc

Compressor: K1A: relay SPST max 0.5A, max 24V, 30000 cycles
Compressor + Evaporator fans, K1B: relay SPST 3FLA – 6A LRA, 48Vdc, 30000 cycles
Evaporator fans/ Pump, K2: relay SPST, 3FLA – 6A LRA, 48Vdc, 30000 cycles
Electrical resistors, K3: relay SPST,3A, 48Vdc, 30000 cycles
Alarm, K4: relay SPDT,
N.C. 2A – 115/250Vac, 30000 cycles
N.O 2A – 115/250Vac, 30000 cycles

Serial output : TTL standard.
2 x analogue outputs: 0-10V, minimum impedance of the input circuit 10Kohm
Communication protocol: Modbus – RTU.
Data storing: on non-volatile memory (EEPROM).
Type of action: 1B;
Pollution degree: 3.
Software class: A
Operating temperature: from 20 to 60°C.
Storage temperature: from -40 to 90°C.
Relative humidity: <90% (without condensing).
Measurement range:
NTC probe: from -40 to 110°C (from -40 to 230°F).
Resolution: 0.1°C or 1°C or 1°F (selectable).
Accuracy at 25°C: ±0.7°C ±1 digit

20. STANDARDS AND DIRECTIVES

The XW07K board complies with the following standards

20.1 European Standards

- *EN 60730-1: 2011*
- *EN 60730-2-6:2008*
- *EN 60730-2-9:2010*
- *EN 60730-2-13:2008*
- *EMC Directive of the Council 2014/30/EU*
- *LVD Directive of the Council 2014/35/EU*

20.2 US standards

- *UL60730-1*
- *CAN/CSA-E60730-1*

21. TEMPERATURE REGULATION

21.1COMPRESSOR ACTIVATION DELAY

21.1.1 OPERATING LOGIC

The ACP parameter delays the activation of the compressor from the start-up of the controller (power on).
With the value set to **0**, the delay will not be considered.

21.1.2 SUMMARY OF PARAMETERS

ACP*	Start-up delay upon power-on	**0 - 15 (min.)**

21.2 Cooling with compressor

OPERATING LOGIC

1) Compressor ON-OFF

The compressor control will be associated with digital output **K1**.
In this case, the **proportional +integral** adjustment mode will not be used and the parameter should be preferably hidden.

"Absolute" control

Relay **K1** will be opened when the temperature read by probe **B1** will be ≤ than the **Cooling setpoint (SET)**; it will be closed when the temperature will be ≥ than the **Cooling setpoint** + **cooling hysteresis (HY)**

Parameters

SEt	Adjustment setpoint	[LS ÷ US]
LS	Lower setpoint limit	°C[-40.0 ÷ SEt] °F[-40 ÷ SEt]
US	Upper setpoint limit	°C[Set ÷ 110.0] °F[Set ÷ 230]
HY	Hysteresis / Proportional band (AO2=CPr)	°C[0.1- 25.0] °F[1 - 45]

"Relative to TExt" check

If the temperature detected by probe **B3 "External temperature" (P3c= EtP)**+ **Cooling setpoint (SET)** will be ≤ than the **Lower operating limit (lOL)**, relay **K1** will be open when the temperature read by probe **B1** will be ≤ than the **Lower operating limit (lOL);** it will be closed when the temperature of probe **B1** will be ≥ than the **Lower operating limit** + **Cooling hysteresis**.

If the temperature detected by probe **B3 "External temperature" (P3c= EtP)**+ **Cooling setpoint** will be ≥ than the **Upper operating limit**, relay **K1** will be open when the temperature read by probe **B1** will be ≤ than the **Upper operating limit;** it will be closed when the temperature of probe **B1** will be ≥ than the **Upper operating limit** + **Cooling hysteresis**.
If the temperature detected by probe **"External temperature"** + **Cooling setpoint** will be ≥ than the **Upper operating limit (UOL)** and > than the **Lower operating limit (LOL)**, relay **K1** will be open when the temperature difference detected by probes **B1** - **"External temperature" B3** will be ≤ than the **Cooling setpoint**; it will be closed when the temperature difference detected by probes **B1** - **"External temperature" B3** will be ≥ than the **Cooling setpoint** + **cooling hysteresis**.

Basically, a dynamic setpoint is calculated and is equal to the sum of **"External temperature"** + **Cooling setpoint**:

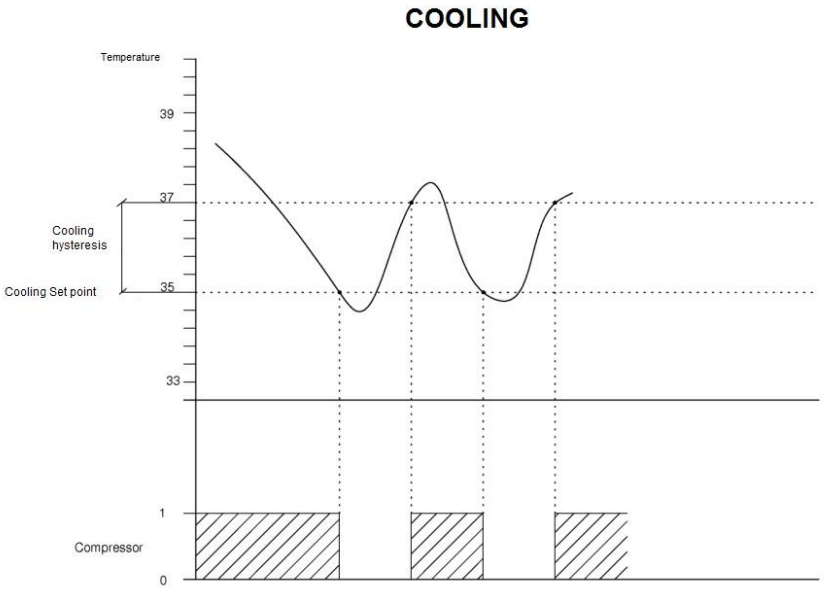
- If this value is ≥ than the **Upper operating limit**, the dynamic setpoint will be fixed and will coincide with the **Upper operating limit**
- If it is ≤ than the **Lower operating limit** the dynamic setpoint will be fixed and will coincide with the **Lower operating limit**.
- If the value is between the **Upper operating limit** and the **Lower operating limit**, it may vary based on the temperature detected by the **"External temperature"** probe.

Bear in mind that the following conditions must be met before the compressor starts:

- The minimum switch-off time must be ≥ than the corresponding value set under the parameter **Minimum compressor switch-off time (AC)**
- The time elapsed from the previous start-up must be ≥ than the corresponding time set under the parameter **Minimum time between two compressor start-ups (OiC)**

Bear in mind that the following conditions must be met before the compressor turns off:

- The compressor operating time must be ≥ than the corresponding value set under the parameter **Minimum compressor start-up time (OtC)**
- If the **Hot gas bypass** function is enabled, the compressor will turn off only when the **ON time for the Hot gas bypass (HGt)** has elapsed. The **ON time for the Hot gas bypass** counter will start when the temperature detected by probe **B1** will be ≤ than the **Cooling setpoint** (therefore when the compressor would normally turn off).



Moreover, relay **K1** will be open in the following cases:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable** or **as Winter Stand-by**
  In this case, if the compressor is active, it stops once the **Minimum compressor start-up time** has elapsed
- Machine status **OFF** from keyboard
  In this case, if the compressor is active, it stops once the **Minimum compressor start-up time** has elapsed
- Alarms that turn it off
  In this case the **Minimum compressor start-up time**, **Minimum compressor switch-off time**, **Minimum time between two compressor start-ups** must not be respected.

- **Parameters**

CMt	Temperature control mode (Absolute/External T°)	AbS(0) - EtP(1)
LFi	Lower operating limit	°C[-40.0 ÷ LFS] °F[-40 ÷ LFS]
LFS	Upper operating limit	°C[LFi ÷ 110.0] °F[LFi ÷ 230]
AC	Anti-short cycle delay (switch-off - start-up)	0 - 50 (min.)
OtC	Compressor on minimum time	0 - 15 (min)
OiC	Time between 2 compressor start-ups	0 - 15 (min)

2) Variable compressor

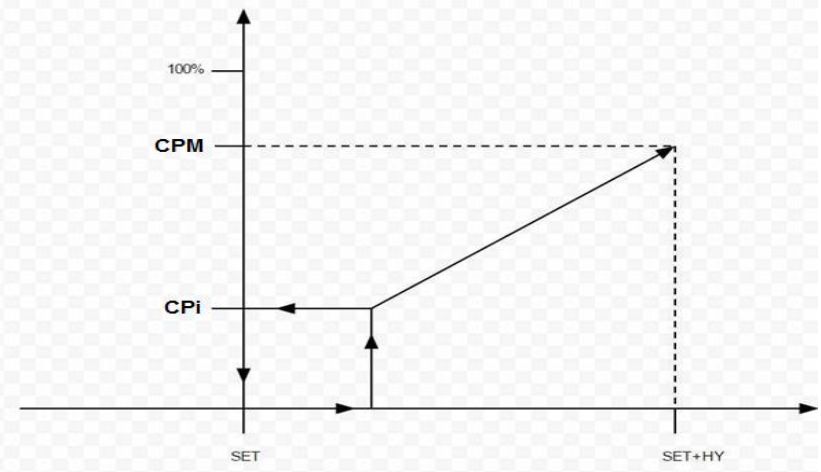
The compressor control will be associated with analogue output **AO2**.
The analogue output range is defined by the two compressor power parameters CPM (maximum) and CPi (minimum) if AO2 = CPS is set.
These parameters represent, as a percentage, the maximum and minimum that the analogue output AO2 may take = CPS.

The compressor is switched on once the control requires a power greater than the minimum CPi. The compressor power increases linearly up to maximum CPM when the control requests 100%. When the required power decreases and the control requests values below minimum CPi, the compressor remains at minimum CP and switches off when the request is 0%.
In practice:

- Regulation temp. (TR) < (SET+ (CPi% * HY)) and compressor off, then AO2 = 0
- (SET+ (CPi% * HY)) < TR < (SET + HY) then

$$AO2 = CPi\% + \left(TR - \left(SET + (CPi\% * HY)\right)\right) * \frac{CPM\% - CPi\%}{HY - (CPi\% * HY)}$$

- SET < TR < (SET + (CPi%*HY)) and compressor on, then AO2 = CPi%
- When TR is again below SET, then AO2 = 0%

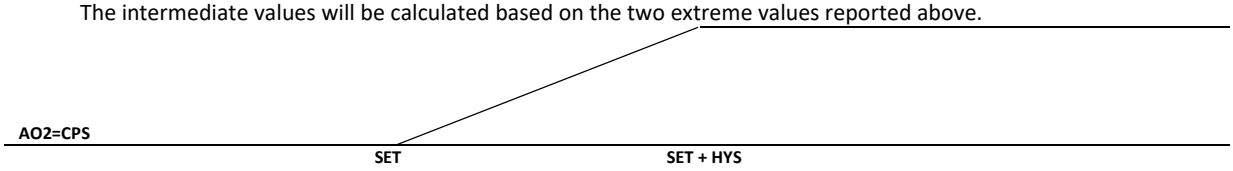


NOTE: in the following examples CPi = 0 and CPM = 100

"Proportional" adjustment

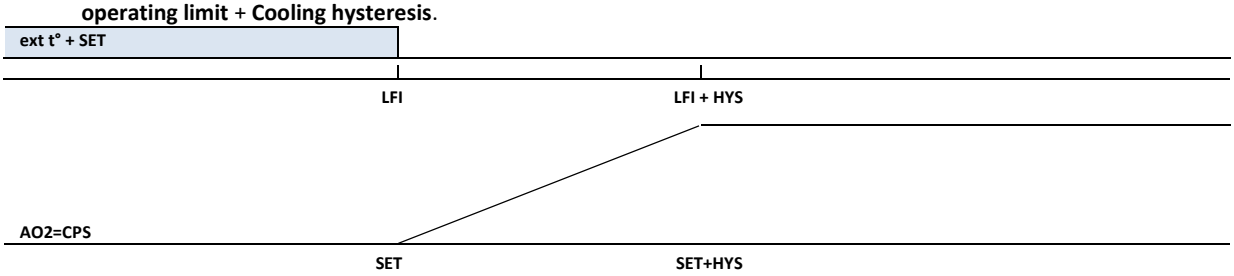
"Absolute" control

The analogue output will be 0V (0%) when the temperature read by probe **B1** will be ≤ than the **Cooling setpoint**; it will be 10V (100%) when the temperature will be ≥ than the **Cooling setpoint + cooling hysteresis.**
The intermediate values will be calculated based on the two extreme values reported above.

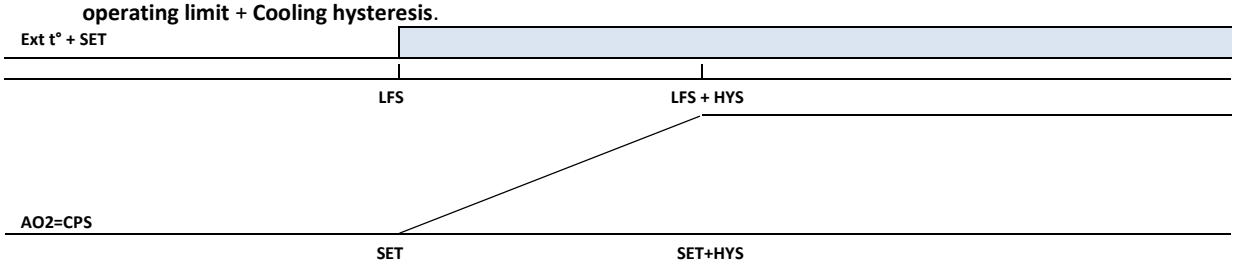


"Relative to TExt" check

If the temperature detected by probe **"External temperature"** + **Cooling setpoint** will be ≤ than the **Lower operating limit**, the analogue output will be 0V (0%) when the temperature read by probe **B1** will be ≤ than the **Lower operating limit**; it will be 10V (100%) when the temperature of probe **B1** will be ≥ than the **Lower operating limit** + **Cooling hysteresis**.

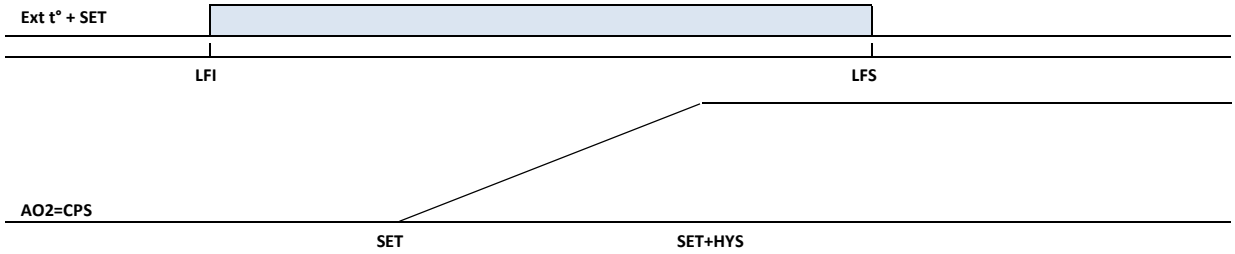


If the temperature detected by probe **"External temperature"** + **Cooling setpoint** will be ≥ than the **Upper operating limit**, the analogue output will be 0V (0%) open when the temperature read by probe **B1** will be ≤ than the **Upper operating limit**; it will be 10V (100%) when the temperature of probe **B1** will be ≥ than the **Upper operating limit** + **Cooling hysteresis**.



If the temperature detected by the **"External temperature"** probe + **Cooling setpoint** will be < than the **Upper operating limit** and > than the **Lower operating limit**, the analogue output will be 0V (0%) when the temperature difference detected by probes **B1** - **"External temperature"** will be ≤ than the **Cooling setpoint**; it will be 10V

(100%) when the temperature difference detected by probes **B1** - **"External temperature"** will be ≥ than the **Cooling setpoint** + **cooling hysteresis**.



Basically, a dynamic setpoint is calculated and is equal to the sum of **"External temperature"** + **Cooling setpoint**:

- If this value is ≥ than the **Upper operating limit**, the dynamic setpoint will be fixed and will coincide with the **Upper operating limit**
- If it is ≤ than the **Lower operating limit** the dynamic setpoint will be fixed and will coincide with the **Lower operating limit**
- If the value is between the **Upper operating limit** and the **Lower operating limit**, it may vary based on the temperature detected by the **"External temperature"** probe

The intermediate values will be calculated based on the two extreme values reported above.

"Proportional + integral" adjustment

"Absolute" control

The analogue output will be modulated from 0V (0%) to 10V (100%) according to the error between the **Cooling setpoint** and temperature **B1**, by considering the **Cooling hysteresis** parameters to calculate the proportional component and the **Integral cooling time** to calculate the integral component.

"Relative to TExt" check

The analogue output will be modulated from 0V (0%) to 10V (100%) according to the error between the temperature difference detected by probes **B1** - **"External temperature"** and the **Cooling setpoint**, by considering the **Cooling hysteresis** parameters to calculate the proportional component and the **Integral cooling time** to calculate the integral component.
If the temperature detected by probe **"External temperature"** + **Cooling setpoint** will be ≤ than the **Lower operating limit**, the analogue output will modulate according to the error between the temperature detected by probe **B1** and the **Lower operating limit**; if this will be ≥ than the **Upper operating limit**, the analogue output will modulate according to the error between the temperature detected by probe **B1** and the **Upper operating limit**.
Basically, a dynamic setpoint is calculated and is equal to the sum of **"External temperature"** + **Cooling setpoint**:

- If this value is ≥ than the **Upper operating limit**, the dynamic setpoint will be fixed and will coincide with the **Upper operating limit**
- If it is ≤ than the **Lower operating limit** the dynamic setpoint will be fixed and will coincide with the **Lower operating limit**.
- If the value is between the **Upper operating limit** and the **Lower operating limit**, it may vary based on the temperature detected by the **"External temperature"** probe.

Bear in mind that the following conditions must be met before the compressor starts:

- The minimum switch-off time must be ≥ than the corresponding value set under the parameter **Minimum compressor switch-off time (AC)**
- The time elapsed from the previous start-up must be ≥ than the corresponding time set under the parameter **Minimum time between two compressor start-ups (OiC)**

Bear in mind that the following conditions must be met before the compressor turns off:

- The compressor operating time must be ≥ than the corresponding value set under the parameter **Minimum compressor start-up time (OtC)**

Moreover, analogue output **AO2** will be 0V (0%) in the following cases as well:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable** or **as Winter Stand-by**
  In this case, if the compressor is active, it stops once the **Minimum compressor start-up time** has elapsed
- Machine status **OFF** from keyboard
  In this case, if the compressor is active, it stops once the **Minimum compressor start-up time** has elapsed
- Alarms that turn it off
  In this case the **Minimum compressor start-up time**, **Minimum compressor switch-off time**, **Minimum time between two compressor start-ups** must not be respected.

OPERATING LIMITS

The maximum value that can be set for the **Cooling setpoint** must be ≤ than the **Upper cooling limit**.
The minimum value that can be set for the **Cooling setpoint** must be:

- ≥ than the highest value between the **Lower cooling limit** and the **Heating setpoint** if the cooling control mode is **"Absolute"**.
- ≥ than the value of the **Lower cooling limit** if the cooling control mode is **"Relative to TExt"**.

21.3 Heating with the heating element

OPERATING LOGIC

The control of the heating element will be associated with digital output **K3**. The heating element can only be activated if the "**operating mode**" is set to active **(par. HtE=yES)**. Relay **K3** will be opened when the temperature read by probe **B1** will be ≥ than the **Heating setpoint (par. SEH)**; it will be closed when the temperature will be ≤ than the **Heating setpoint - heating hysteresis (HYH)**.

Moreover, relay **K3** will be open in the following cases:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable**
  In this case, if the heating element is on, it turns off
- Machine status **OFF** from keyboard
  In this case, if the heating element is on, it turns off
- Alarms that turn it off
  In this case, if the heating element is on, it turns off

If input **DI1** is set to **Winter stand-by**, relay **K3** will be open when the temperature read by probe **B1** will be ≥ than the **Heating setpoint**; it will be closed when the temperature will be ≤ than the **Heating setpoint – hysteresis.**

OPERATING LIMITS

The maximum value that can be set for the **Heating setpoint** must be:

- ≤ of the lowest value between the **Upper heating limit** and the **Cooling setpoint** if the cooling control mode is **"Absolute"**.
- ≤ of the lowest value between the **Upper heating limit** and the **Lower operating limit** if the cooling control mode is **"Relative to TExt"**.

The minimum value that can be set for the **Heating setpoint** must be ≥ than the **Lower heating limit**.

SUMMARY OF PARAMETERS

HtE	Heater regulator enabling	no(0) - yES(1)
SEH	HEATER regulator setpoint	(CMt=AbS) °C[LSH ÷ USH/SEt] °F[LSH + USH/SEt] (CMt=EtP) °C[LSH ÷ USH/LFi] °F[LSH + USH/LFi]
LSH	HEATER lower setpoint limit	°C [-40.0°C ÷ SEH] °F [-40°F ÷ SEH]
USH	HEATER upper setpoint limit	°C[SEH ÷ 110.0] °F[SEH ÷ 230]
HYH	HEATER regulator differential	°C[0.1 - 25.5] °F[1 - 45]

21.4 Hot gas bypass

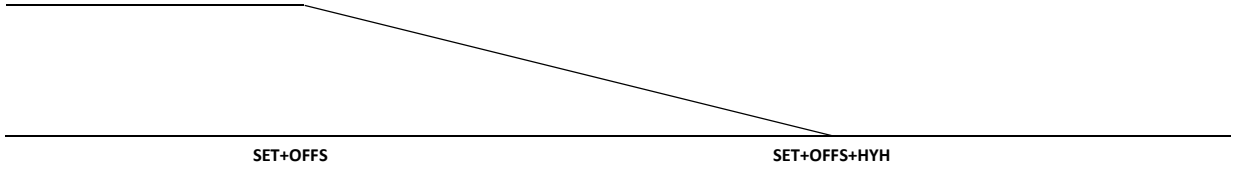
OPERATING LOGIC

The Hot gas bypass valve control will only be active if analogue output **AO2** is associated with the Hot gas bypass function.

"Proportional" adjustment

The analogue output will be used as if it was a digital output modulated by the request based on the proportional calculation.

Therefore, the percentage calculation will be 100% when the temperature read by probe **B1** will be ≤ than the **Cooling setpoint + Offset Hot gas bypass**; it will be 0% when the temperature will be ≥ than the **Cooling setpoint + Offset Hot gas bypass + Hot gas bypass hysteresis.**



"Proportional + integral" adjustment

In proportional + integral adjustment, the percentage calculation will be according to the error between the **Cooling setpoint** + **Hot gas bypass offset** and temperature **B1**, by considering the **Hot gas bypass hysteresis** parameters to calculate the proportional component and the **Hot gas bypass integral time** to calculate the integral component.

The higher the temperature error read by probe **B1** in relation to the value of the **Cooling setpoint** + **Hot gas bypass offset**, the lower the percentage value and therefore the ON time of the Hotgas bypass valve.

It means that the 100% contribution of the proportional is achieved when **B1** < **Cooling setpoint** + **Hot gas bypass offset (HGO) – HGB Hysteresis (HGd)** and proportional contribution = 0% when **B1** > **Cooling setpoint** + **Hot gas bypass offset (HGO)**. And it means that the regulation point is **Cooling setpoint + Offset (HGO).**

For both regulations, the **Cooling setpoint** is used, which depends on parameter **CMt**. In fact, if **CMt** is = **AbS**, then the setpoint is simply the **SEt** value between **LS** and **US**, while if **CMt** = **EtP**, then the **Cooling setpoint** is = to the value of probe **B3 (External Temperature)** + **SEt**. All included between the limits **LFi** and **LFS** as described in paragraph "Cooling with compressor" of the starting specification.

The **Hot gas bypass offset** must always be a positive relative value in relation to the **Cooling setpoint.**

The cycle time will be required for both adjustments (proportional and proportional + integral) and will be used to calculate the ON time (10V - 100%) and the OFF time (0V - 0%) of the Hot gas bypass valve.
E.g. if the percentage calculation deriving from the above logics is 40% and given a cycle time of 10 sec., the value of the analogue output will be 100% for 4 sec. and 0% for 6 sec.

Moreover, analogue output **AO2** will be 0% in the following cases as well:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable** or **as Winter Stand-by**
  In this case, if the Hot gas bypass valve is on, it turns off once the compressor is off
- Machine status **OFF** from keyboard
  In this case, if the Hot gas bypass valve is on, it turns off once the compressor is off
- Alarms that turn it off
  In this case, if the Hot gas bypass valve is on, it turns off once the compressor is off

SUMMARY OF PARAMETERS

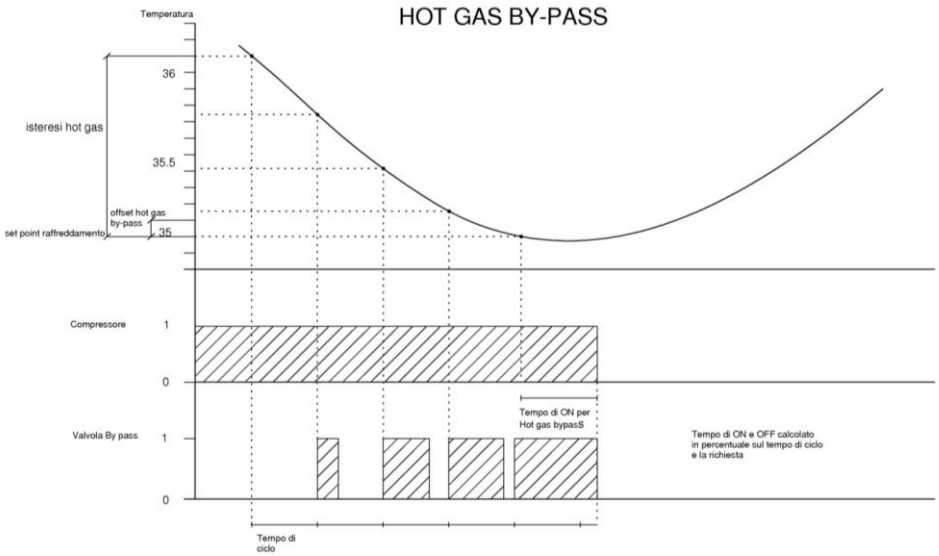
AO2	Analogue output 2 function	nu(0) - HGb(1) - CPS(2)
HGO	Offset Hot Gas bypass	°C[0.0-25.5] °F[0-45]
HGd	Hot Gas bypass differential	°C[0.0-25.5] °F[0-45]
HGi	Hot Gas bypass Integral Time	0 - 255 (sec)
HGC	Cycle time for Hot Gas bypass	5 - 99 (sec)
HGt	Hot Gas bypass ON time	0 - 9.5(59) (min.10sec)

21.5VARIABLES COMPRESSOR MANAGEMENT

21.6Analogue output voltage range

21.6.1 OPERATING LOGIC

Add a parameter to define the voltage range to be used on analogue output **AO2**.
The percentage calculation to control the device connected to output **AO2** must be readjusted on a separate voltage range according to the selection of the parameter.
SUMMARY OF PARAMETERS



AT2*	Analogue output 2 function	**0..10V(0) - 0..5V(1)**

* The name of the parameter is purely indicative and can be changed.

E.g.

If the control percentage of the compressor is 50%, with the parameter set to:

- 0..5V --> Output voltage **AO2** = 2.5V
- 0..10V --> Output voltage **AO2** = 5V

21.7K1 relay management

OPERATING LOGIC

If analogue output **AO2** is associated with the control of the variable compressor, digital output **K1** must change the operating logic as follows:

- Turn on when the request percentage of the compressor is > 0%
- Turn off when the request percentage of the compressor is = 0%

If there are any delays for the activation of the compressor, then also the value of analogue output will remain 0 until the compressor is activated.

[NOTE: Sandro]

In this mode the compressor does not adjust, it is used as a "switch" for analogue output 2. However, all the delay and protection times relating to the start-up of the compressor remain active.

In all the other cases, the current logic remains in place.

22. FAN / PUMP MANAGEMENT

22.1 Evaporator / pump fan

OPERATING LOGIC

The control of the evaporator / pump fan will be associated with digital output **K2**.

One must be able to configure the evaporator / pump fan in order to obtain the following:

1) Fan / pump always on

The fan / pump turns off only in the following cases:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable**
  In this case, the fan / pump stops after the **Switch-off delay** and only if the compressor is off
- Machine status **OFF** from keyboard
  In this case, the fan / pump stops after the **Switch-off delay** and only if the compressor is off
- Alarms that turn it off
  In this case, the **Switch-off delay** must not be respected, but the compressor must be off

If input **DI1** is set to **Winter stand-by** and the **Winter stand-**by enabling is active, relay **K2** will be open when the temperature read by probe **B1** will be ≥ than the **Heating setpoint**; it will be closed when the temperature will be ≤ than the **Heating setpoint - heating hysteresis.**

If input **DI1** is set to **Winter stand-by** mode and the **Winter stand-**by enabling is not active, relay **K2** will always remain open.

2) SEM^2 mode (Fan / pump running only with cooling or heating on)

The evaporator / pump fan turns on only when the heating or cooling is due to turn on.

After the heating or cooling cycle has ended, wait for the **Switch-off delay** before deactivating the fan / pump.

Moreover, the fan / pump turns off also in the following cases:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable**
  In this case, the fan / pump stops after the Switch-off delay and only if the compressor is off
- Machine status OFF from keyboard
  In this case, the fan / pump stops after the **Switch-off delay** and only if the compressor is off
- Alarms that turn it off
  In this case, the **Switch-off delay** must not be respected, but the compressor must be off

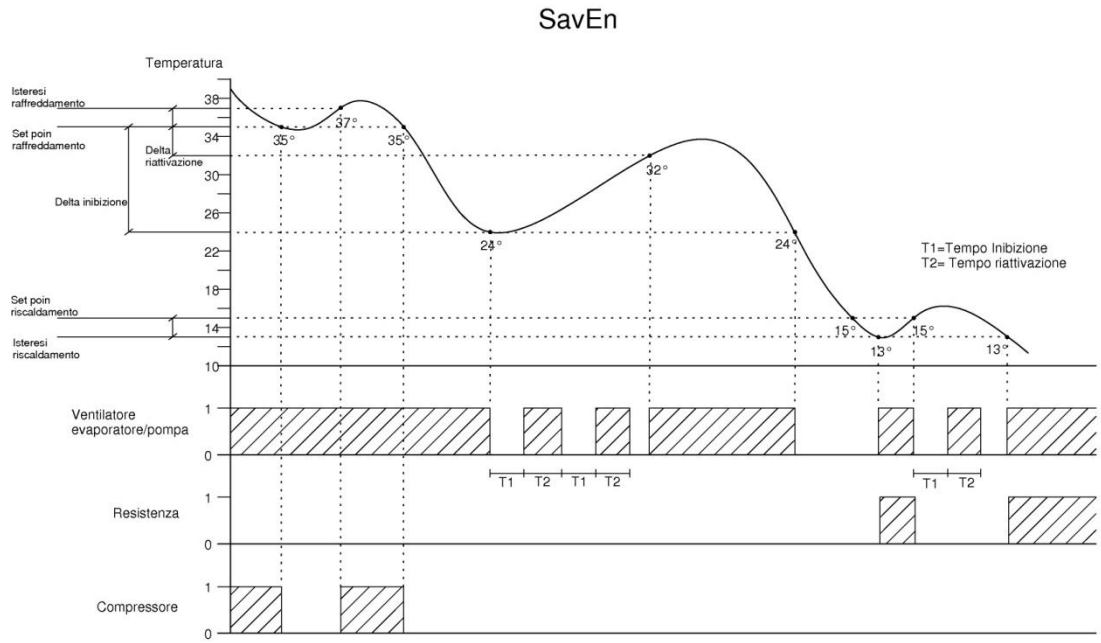
If input **DI1** is set to **Winter stand-by** and the **Winter stand-**by enabling is active, relay **K2** will be open when the temperature read by probe **B1** will be ≥ than the **Heating setpoint**; it will be closed when the temperature will be ≤ than the **Heating setpoint - heating hysteresis.**

If input **DI1** is set to **Winter stand-by** mode and the **Winter stand-**by enabling is not active, relay **K2** will always remain open.

3) SEM mode

The fan / pump goes into **SEM** mode when the temperature is ≤ than the **cooling setpoint - inhibition delta**; it exits **SEM** mode when the temperature is ≥ than the **cooling setpoint - reactivation delta**.
In **SEM** mode, the fan / pump runs for the **reactivation time** and remains off for the **inhibition time**; in the other cases, the fan / pump remains always on.

If the **control mode** of the **heating with heating element** is **enabled**, the evaporator / pump fan turns on when the heating element turns on and turns off when the heating element turns off. The inhibition time is reset when the fan / pump turns on and the count restarts when the evaporator / pump fan is turned off.



Moreover, the fan / pump turns off also in the following cases:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable**
  In this case, the fan / pump stops after the **Switch-off delay** and only if the compressor is off
- Machine status **OFF** from keyboard
  In this case, the fan / pump stops after the **Switch-off delay** and only if the compressor is off
- Alarms that turn it off
  In this case, the **Switch-off delay** must not be respected, but the compressor must be off

If input **DI1** is set to **Winter stand-by** and the **Winter stand-**by enabling is active, relay **K2** will be open when the temperature read by probe **B1** will be ≥ than the **Heating setpoint**; it will be closed when the temperature will be ≤ than the **Heating setpoint - heating hysteresis.**
If input **DI1** is set to **Winter stand-by** mode and the **Winter stand-**by enabling is not active, relay **K2** will always remain open.

22.1.1 Summary of parameters

FCM	Fans/Pump: control mode	on(0) - SE(1) - SE2(2)
FUE	Fans/Pump: Winter stand-by mode enabling	no(0) - yES(1)
Fdi	Fans/Pump: Inhibition delta	°C[0.0 - 25.5] °F[0 - 50]
Fdr	Fans/Pump: Reactivation delta	°C[0.0 - 25.5] °F[0 - 50]
Fti	Fans/Pump: Inhibition time	0 - 99 (min.)
Ftr	Fans/Pump: Reactivation time	0 - 99 (min.)
FFd	Fans/Pump: Switch-off delay	0 - 99 (min.)

22.2 Condenser fan

OPERATING LOGIC

The control of the condenser fan will be associated with analogue output **AO1** and will only be active when the compressor is running.

One must be able to configure the condenser fan in order to obtain the following:

1) No control

In this case, there is no condensation control and therefore analogue output **AO1** remains at 0V.

2) Temperature Control

"Proportional adjustment" mode

Analogue output **AO1** will be 0V when the **"Condenser coil temperature"** read by probe **B3** will be ≤ than the **Condensation set point**; it will be 10V when the **"Condenser coil temperature"** will be ≥ than the **Condensation set point** + **Condensation hysteresis**.

"Proportional + integral adjustment" mode

Analogue output **AO1** will vary its values by using **Condensation hysteresis** as a proportional band and the **Condensation integral time** as the integral time to calculate its value.

When the compressor starts, the condenser fan control will start as well with a value equal to the **Forcing percentage** for a time equivalent to the **Forcing time**. During this period, the calculation of the speed must be carried out in the background, so that it can be used immediately when the **Forcing time** elapses.

Moreover, analogue output **AO1** will be 0V in the following cases as well:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable** or **as Winter Stand-by**
  In this case, if the condenser fan is active, it turns off with the compressor
- Machine status **OFF** from keyboard
  In this case, if the condenser fan is active, it turns off with the compressor
- Alarms that turn it off
  In this case, if the condenser fan is active, it turns off with the compressor

3) Pressure control

"Proportional adjustment" mode

Analogue output **AO1** will be 0V when the **"Condenser pressure"** temperature read by probe **B3** will be ≤ than the **Condensation setpoint**; it will be 10V when the **"Condenser pressure"** temperature will be ≥ than the **Condensation setpoint + condensation hysteresis**

"Proportional + integral adjustment" mode

The analogue output will vary its values by using the **condensation hysteresis** as a proportional band and the **condensation integral time** as the integral time to calculate its value.

In this case, the **Forcing percentage** and the **Forcing time** will not be used, as the control will calculate the percentage value according to the condensation pressure.

Moreover, analogue output **AO1** will be 0V in the following cases as well:

- Opening of the contact connected to digital input **DI1** if configured as **Remote enable** or **as Winter Stand-by**
  In this case, if the condenser fan is active, it turns off with the compressor
- Machine status **OFF** from keyboard
  In this case, if the condenser fan is active, it turns off with the compressor
- Alarms that turn it off
  In this case, if the condenser fan is active, it turns off with the compressor

22.2.1 Summary of parameters

StC	Condensation set point	°C[-40.0 to 110.0] °F[-40 to 230] BAR[LCi ÷ UCi] PSI[LCi ÷ UCi]
HYC	Condensation hysteresis / Proportional band (AO1)	°C[0.1 - 25.5] °F[1 - 45] BAR[0.1 - 25.5] PSI[1 - 45]
Cin	Condensation PI integral time	0 - 255 (sec)
CSP	Condenser fans percentage at start-up	0 - 100 (%)
CSt	Condenser fans start-up time	0 - 99 (sec)

23. MACHINE STATUSES

23.1 ON / OFF

The ON / OFF status can be activated from the button on the display.
The ON / OFF key works only if enabling of the ON / OFF key is active by alternatively switching the machine status from ON to OFF and vice versa.
The setting will be active only if the control will be set to ON and its STAND-BY or WINTER STAND-BY statuses are deactivated.
The alarm relay remains in the normal operating status.

23.2 STAND-BY

The STAND-BY status is associated with digital output DI1 if this is configured as Remote enable.
If the contact connected to it is activated, the control does not need to carry out any adjustment and turn off all the devices connected to the analogue and digital outputs.
In the event of OFF status from the keyboard and disabled STAND-BY, the control will not carry out any adjustment and the OFF status will not be displayed as a priority compared to the STAND-BY status.
The setting will be active only if the control will be set to ON and its STAND-BY status will be deactivated.
The alarm relay remains in the normal operating status.

23.3 DISPLAY

If OFF from a key or STB from DI, the machine does not need to make adjustments. The display shows three labels:
OFF (OFF from a key)
Stb (OFF from DI=OFF)
USb (OFF from DI=USB).

24. ALARMS

24.1 ALARM MANAGEMENT WITH DIFFERENT MACHINE STATUSES

24.1.1 OPERATING LOGIC

The ALS parameter is used to define in which controller status an alarm will be displayed and the alarm relay will be managed. This feature is also used to display alarms even if the unit is in a status other than **ON**.

Therefore, the display of the active alarms depends on the status of the machine and on the “ALS” parameter.

The “ALS” parameter has 4 modes, as described here below:

- ALS = ON - OFF - Stb - OSb

The 4 tables below indicate which alarms are shown and managed according to the ALS value and the machine status:

ALARMS	ALS = ON				ALS = OFF			
	MACHINE STATUSES				MACHINE STATUSES			
	On	OFF	STDBY	USB	On	OFF	STDBY	USB
b1	X	-	-	X	X	X	-	X
b2	X	-	-	X	X	X	-	X
b3	X	-	-	X	X	X	-	X
b4	X	-	-	X	X	X	-	X
HA	X	-	-	-	X	X	-	-
LA	X	-	-	-	X	X	-	-
LA2	X	-	-	X	X	X	-	X
HAS	X	-	-	-	X	-	-	-
HP	X	-	-	-	X	X	-	-
LP	X	-	-	-	X	-	-	-
bLP	X	-	-	-	X	-	-	-
SEC	X	-	-	X	X	X	-	X
FLU	X	-	-	X	X	-	-	X
bFL	X	-	-	X	X	-	-	X

ALARMS	ALS = STB				ALS = OSB			
	MACHINE STATUSES				MACHINE STATUSES			
	On	OFF	STDBY	USB	On	OFF	STDBY	USB
b1	X	-	X	X	X	X	X	X
b2	X	-	X	X	X	X	X	X
b3	X	-	X	X	X	X	X	X
b4	X	-	X	X	X	X	X	X
HA	X	-	X	X	X	X	X	X
LA	X	-	X	X	X	X	X	X
LA2	X	-	X	X	X	X	X	X
HAS	X	-	-	-	X	-	-	-
HP	X	-	X	X	X	X	X	X
LP	X	-	-	-	X	-	-	-
bLP	X	-	-	-	X	-	-	-
SEC	X	-	X	X	X	X	X	X
FLU	X	-	-	X	X	-	-	X
bFL	X	-	-	X	X	-	-	X

24.1.2 SUMMARY OF PARAMETERS

ALS*	Status of the control to display the alarms and relative relay	**"On"** 0= Unit **ON** **"OFF"** 1= Unit **ON**, **OFF** from keyboard **"Stb"** 2= Unit **ON**, **Stand-by / Winter stand-by** only from digital input **"OSb"** 3= Unit **ON**, **OFF** from keyboard and **Stand-by / Winter stand-by** from digital input

* The value assigned to the parameter is purely indicative and can be changed.

NOTE: The sequencing **Stand-by** status is equivalent to the **ON** status of the unit. Therefore, if the unit is in **Stand-by** mode due to the sequencing and an alarm occurs on that unit, the display must show, even if it will be refused, the **Stand-by / Winter stand-by** mode.

24.2 General alarm

The **general** alarm is connected to digital output **K4**.
When an alarm condition occurs, the display shows the corresponding message and the status of the digital output changes.

If there is no alarm, the coil of relay **K4** must be powered on, so that the relay changes status even if there is no power supply on the controller.

24.3 Temperature

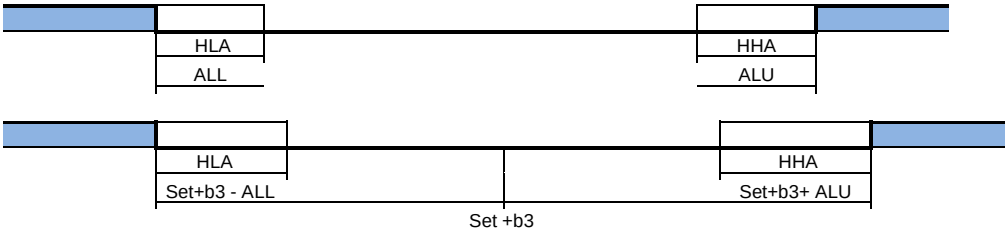
OPERATING LOGIC

The high temperature alarm is triggered when the temperature of the designated probe is:

- higher or equal to ALU if **ALC**=**Ab(solute)**
- higher or equal to the ***setpoint*** + ALU if **ALC**=**re(lative)**

The low temperature alarm is triggered when the temperature of the designated probe is:

- equal to or less than ALL if **ALC**=**Ab(solute)**
- equal to or less than the ***setpoint*** + ALL if **ALC**=**re(lative)**



When one of the two above conditions occurs, this triggers the generic alarm LED and the buzzer if there are no alarm exclusion times in progress. The high temperature alarm is cleared when the temperature of the designated probe is:

- lower or equal to: **ALU - HHA** if **ALC**=**Ab(solute)**
- lower or equal to : ***setpoint* + ALU - HHA** if **ALC**=**re(lative)**

The low temperature alarm is cleared when the temperature of the designated probe is:

- higher or equal to: **ALL + HLA** if **ALC**=**Ab(solute)**
- higher or equal to : ***setpoint* + ALL - HLA** if **ALC**=**re(lative)**

The ***setpoint*** value (it is so called to distinguish it from parameter **SEt**) used is the one calculated by the controller for compressor operation.

So, if we are:

- in absolute control mode **CMt = AbS** then *setpoint* = **SEt**.
- with **CMt = EtP** we will have *setpoint* = **SEt + b3** (value read by probe b3 configured as external air probe).
  It is necessary to consider that the *setpoint* calculated in relative is limited by parameters **LFi** and **LFS**.

24.3.1 High temperature

OPERATING LOGIC

The alarm is triggered when the temperature read by probe **B1** is ≥ than the **High temperature alarm setpoint**; it is deactivated when temperature **B1** will be ≤ than the **High temperature alarm setpoint** - **High temperature alarm hysteresis**.

24.3.2 Low temperature

OPERATING LOGIC

The alarm is triggered when the temperature read by probe **B1** is ≤ than the **Low temperature alarm setpoint**; it is deactivated when temperature **B1** will be ≥ than the **Low temperature alarm setpoint** - **Low temperature alarm hysteresis**.

24.3.3 Summary of parameters

ALC	Alarm configuration: relative / absolute	AbS(0) - rEL(1)
ALL	Low temperature alarm	°C[0.0 - 40.0 or ALL - 110.0] °F[0 - 90 or ALL - 230]
ALU	High temperature alarm	°C[0.0 - 40.0 or -40.0 - ALU] °F[0 - 90 or -40 - ALU]
HLA	Low temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
HHA	High temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
ALd	Temperature alarm delay (in normal mode)	0 - 99 (min.)
dAo	Temperature alarm exclusion at power on	0 - 9.5(59) (hours.10m)

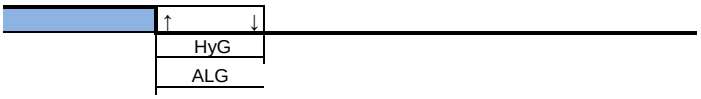
24.4 Anti-freeze

OPERATING LOGIC

The alarm is enabled only is probe P2 (Evaporator coil temperature) is set as present: P2C = yES.

If **P2** is set as not present (par. **P2C = no**) or there is a probe error, the setting is not carried out and this temperature alarm is cancelled. This is a low temperature alarm and is reported on the display with label **LA2.**

The alarm is activated when the temperature read by the **Evaporator coil temperature** probe (B2) is ≤ than the **Anti-freeze alarm setpoint** (par. ALG). It is deactivated when the **Evaporator coil temperature** (B2) is ≥ than the **Anti-freeze alarm setpoint** + **Anti-freeze alarm hysteresis** (HYG).



The **Anti-freeze alarm setpoint** defined by parameter **ALG** is always expressed as an absolute value.

When the alarm is activated, the digital and analogue alarms related to the following devices are deactivated:

- Compressor
- Condenser fan

SUMMARY OF PARAMETERS

ALG	Low Anti-freeze alarm	°C[-40.0 to 110.0] °F[-40 to 230]
HYG	Differential for Low Anti-freeze alarm	°C[0.1 -1 25.5] °F[1 - 45]

24.5 High pressure: i2F = HP

OPERATING LOGIC

The **High pressure** alarm is connected to digital input **DI2**
If
The contact connected to it is opened, the control must deactivate the digital and analogue outputs related to the devices after CHP time:

- Compressor
- Condenser fan

During CHP the fan will follow the speed calculated by the Condenser fan control (both in temperature and in pressure).
NOTE
If within this time the HP alarm is reset and there is a cooling demand again, the fan will remain active.

With HP alarm active, the "**HP**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling to normal operation, and therefore the alarm reset, must automatically take place after 30 sec. from the closure of the digital input. The compressor must only restart if all minimum waiting times have elapsed; otherwise, wait for the remaining time before turning on the device.

24.5.1 Summary of parameters

i2F	Digital input 2 function	nu(0) - HP(1)
i2P	Digital input 2 polarity	OP(0) - CL(1)
CHP	HP alarm delay for switch-off, condenser fan	0.1- 9.5 m, res. 10s

24.6 HP Digital input

This digital input, called **HP**, is designed to cut the compressor relay coil.
If the input is activated, there is an immediate action on the compressor stop, while the other actions are equivalent to digital input 2 when it is set as **HP (i2F = HP)**.

If **i2F = HP**, this input and digital input 2 work in "**OR**". Just one of the 2 needs to be activated to generate the alarm signal. They must be both disabled for the machine to go back to normal operation.

24.7 Flow: i3F = FL

OPERATING LOGIC

The **flow** alarm is connected to digital input **DI3**.
When the evaporator/pump fan starts, the input must be inhibited for the **Power fan alarm exclusion** time.
If the contact connected to it is opened, the control must wait for the **Flow alarm delay** time and then deactivate the digital and analogue outputs relative to the following devices:

- Compressor
- Heating element
- Evaporator / pump fan
- Condenser fan

In this condition the display shows the "**FLS**" alarm and the alarm relay output is activated.

After 30 seconds, even if the input is active, the **evaporator/pump fans** are activated and the input must be inhibited for the **Power fan alarm exclusion** time.
After the power fan alarm exclusion time, the tool checks the status of the digital input again: if it is still active, wait for the **Flow alarm delay** and then the evaporator/pump fans are deactivated.
The 30s cycle is repeated until:

a. The digital input is not deactivated.
b. If more than 4 events are detected over 3 hours, this triggers the blockage alarm, the display shows the word "**bFL**" and the recovery will be performed manually by pressing the ARROW DOWN key for 3s.

Even if the alarm is cleared manually, the digital output of the fan / pump will be activated and must follow the logic described above.

24.7.1 Summary of parameters

i3F	Digital input 3 function	nu(0) - FL(1) - SF(2)
i3P	Digital input 3 polarity	OP(0) - CL(1)
FAO	Power fan flow alarm exclusion.	0 - 255 (sec.)
FAd	Flow alarm delay	0 - 255 (sec.)

24.8 Phase sequence: i3F = SF

OPERATING LOGIC

The **Phase sequence** alarm is connected to digital input **DI3**.
If the contact connected to it is opened, the control must deactivate the digital and analogue outputs related to the following devices:

- Compressor
- Heating element
- Evaporator / pump fan
- Condenser fan

In this condition the "**SEC**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling to normal operation, and therefore the alarm reset, must automatically take place after a 10-sec. delay from the closure of the contact connected to the digital input.

24.8.1 Summary of parameters

i3F	Digital input 3 function	nu(0) - FL(1) - SF(2)
i3P	Digital input 3 polarity	OP(0) - CL(1)

24.9 Low pressure: i1F = LP

OPERATING LOGIC

The **low pressure** alarm is connected to digital input **DI1**.
When the compressor turns on, the input must be inhibited for the duration of the **Low pressure inhibition time**.
If the contact connected to it is opened, the control must deactivate the digital and analogue outputs related to the following devices:

- Compressor
- Condenser fan

In this condition the "**LP**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling to normal operation, and therefore the alarm reset, must automatically take place after a 30-sec. delay. When normal operation is restored, it is necessary to reconsider the inhibition of the digital input from when the compressor starts.
If the digital input carries out more than 4 recoveries over 3 hours, the recovery will need to be carried out manually by pressing the ARROW DOWN key for 3 seconds. Even if the alarm is cleared manually, it is necessary to reconsider the inhibition of the digital input from when the compressor starts.

SUMMARY OF PARAMETERS

i1F	Digital input 1 function	nu(0) - OFF(1) - USb(2) - LP(3)
i1P	Digital input 1 polarity	OP(0) - CL(1)
APd	Low pressure alarm delay	0 - 99 (min.)

24.10 Internal temperature / water supply probe fault

OPERATING LOGIC

In the event of a probe fault (short circuit or interruption), the control must wait for a specific period of time from the event (around 10 sec.) and then deactivate all the digital and analogue outputs relative to the following devices:

- Compressor
- Heating element
- Evaporator / pump fan
- Condenser fan

In this condition the "**P1**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling for normal operation, and therefore the alarm reset, must automatically take place after a 10-sec. delay from the regular operation of the probe.

24.11 Evaporator coil temperature probe fault

OPERATING LOGIC

In the event of a probe fault (short circuit or interruption), the control must wait for a specific period of time from the event (around 10 sec.) and then deactivate all the digital and analogue outputs relative to the following devices:

- Compressor
- Heating element
- Evaporator fan
- Condenser fan

In this condition the "**P2**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling for normal operation, and therefore the alarm reset, must automatically take place after a 10-sec. delay from the regular operation of the probe.

24.12 Condensing coil temperature / Water return probe fault

OPERATING LOGIC

In the event of a probe fault (short circuit or interruption), the control must wait for a specific period of time from the event (around 10 sec.) and then deactivate all the digital and analogue outputs relative to the following devices:

- Compressor
- Heating element
- Evaporator / pump fan
- Condenser fan

In this condition the "**P3**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling for normal operation, and therefore the alarm reset, must automatically take place after a 10-sec. delay from the regular operation of the probe.

24.13 Condensation pressure probe fault

OPERATING LOGIC

In the event of a probe fault (short circuit or interruption), the control must wait for a specific period of time from the event (around 10 sec.) and then deactivate all the digital and analogue outputs relative to the following devices:

- Compressor
- Heating element
- Evaporator / pump fan
- Condenser fan

In this condition the "**P4**" alarm is shown on the display and the digital output relative to the general alarm is activated.

The enabling for normal operation, and therefore the alarm reset, must automatically take place after a 10-sec. delay from the regular operation of the probe.

24.14 High suction temperature alarm

OPERATING LOGIC

The alarm is enabled only if analogue input **B3** is associated with the **Suction temperature** probe. (B3 = Sut)
The alarm is managed only if the compressor is on.
The alarm will be triggered after the **Alarm exclusion from dHA compressor start** time and if the temperature read by the **Suction temperature** probe (B3) is ≥ than the **HAS suction temperature alarm setpoint**.
When the alarm is activated, the digital and analogue alarms related to all the devices will be deactivated.

When the alarm is active, the word **HAS** must be shown on the display and the digital output relating to the general alarm must be activated.

The enabling for normal operation, and therefore the alarm reset, must be carried out manually by pressing the DOWN key for 3s, if the **Suction temperature** (B3) is ≤ than the **HAS suction temperature alarm setpoint** - **HHS suction temperature alarm hysteresis**.

PARAMETERS

Label	Parameter	Values
HAS	High suction temperature alarm	-40 to 110°C // -40 to 230°F
HHS	High suction temperature alarm hysteresis	°C[0.1 -1 25.5] °F[1 - 45]
dHA	Exclusion of the high suction alarm upon compressor start-up	0.0-40.0min; resolution 10s

24.15 ALARM IN OFF STATUS

If the controller is set to **OFF**, relay **K4** will go to alarm mode if parameter **AoU** is set to **Yes**; it will not change the status if parameter **AoU** is set to **No**.

PARAMETERS

AoU	OFF status alarm	no(0) - yES(1)

DISPLAY NOTES

When the "**OFF**" alarm is active (machine in "**OFF**" and parameter "**AoU**" = YES), the display will statically alternate the display of the "**OFF**" label for 2 seconds (indicating the operating status of the machine) and for another 2 seconds the same flashing label to indicate the presence of the "**OFF**" alarm.

NOTE 1

The "OFF" alarm is not associated with the ALS parameter that reports alarms in the various operating statuses.

24.16 STAND-BY / WINTER STAND-BY STATUS ALARM

If the controller is set to **Stand-by / Winter stand-by**, relay **K4** will go to alarm mode if parameter **AdO** is set to **Yes**; it will not change the status if parameter **AdO** is set to **No**.

PARAMETERS

AdO	Stand-by status alarm	no(0) - yES(1)

NOTE 1

The "Stand by/ Winter stand by" alarm is not associated with the ALS parameter that reports alarms in the various operating statuses.

DISPLAY NOTES

When the "**Stb**" alarm is active (machine in "**Stand-by**" and parameter "**AdO**" = YES), the display will statically alternate the display of the "**Stb**" label for 2 seconds (indicating the operating status of the machine) and for another 2 seconds the same flashing label to indicate the presence of the "**Stb**" alarm.

When the "**USb**" alarm is active (machine in "**Winter Stand-by**" and parameter "**AdO**" = YES), the display will statically alternate the display of the "**USb**" label for 2 seconds (indicating the operating status of the machine) and for another 2 seconds the same flashing label to indicate the presence of the "**USb**" alarm.

24.17 TABLE WITH THE ALARM CODES

During operation the device can display alarms relating to anomalies that occur. Here is the list of alarm messages:

LABEL	MEANING	MODE
P1	probe B1 alarm	Flashing
P2	probe B2 alarm	alternated with the temp.
P3	probe B3 alarm	alternated with the temp.
P4	probe B4 alarm	alternated with the temp.
HA	high temperature alarm on B1	alternated with the temp.
LA	low temperature alarm on B1	alternated with the temp.
LA2	Anti-freeze low temperature alarm on B2	alternated with the temp.
HP	high pressure alarm	alternated with the temp.
LP	low pressure alarm	alternated with the temp.
bLP	low pressure block alarm	alternated with the temp.
SEC	(three-phase) sequence alarm	alternated with the temp.
FLU	FLOW alarm	alternated with the temp.
bFL	FLOW block alarm	alternated with the temp.
HAS	HIGH suction TEMPERATURE alarm	alternated with the temp.

Stb	**Stand-by** alarm	Flashing
USb	**Winter stand-by** alarm	Flashing
OFF	OFF alarm	Flashing

The activation of any alarm involves:

- the activation of the buzzer, if there is one, and of the alarm output
- the display of the relative notification alarm (shown as flashing), on a rotating basis together with existing alarms alternated with the display of the probe temperature on the selected display (par. Lod). If the display also shows the probe alarm, the display will also show the alarms on a rotating basis.

Rotating sequence of the alarms alternated with the temperature (no probe alarm on the display)

probe t°	**Alarm_1**	**probe t°**	**Alarm_2**	**probe t°**	**Alarm_3**	**probe t°**	**Alarm_1**	**probe t°**	**Alarm_2**
2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds

Rotating sequence of the alarms without the temperature (probe alarm on the display)

Alarm_1	**Alarm_2**	**Alarm_3**	**Alarm_1**	**Alarm_2**	**Alarm_3**	**Alarm_1**	**Alarm_2**	**Alarm_3**	**Alarm_1**
2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds

25. SEQUENCING

OPERATING LOGIC

The **"Sequencing"** mode offers the chance of installing up to 2 units inside the same cabinet in order to increase the cooling / heating power and have backup units in the event of a fault or an increase in temperature inside the cabinet.
Here are the main functions carried out by the units connected in sequencing mode:

a. Automatic rotation to balance the hours of operation
b. Mutual support if:
   1. There is an alarm on a unit that prevents it from operating
   2. The cabinet temperature exceeds the **Temperature threshold for the supporting unit** (the return hysteresis will be defined by the standard operating setpoint).

   This function involves the use of a DI4 digital input that connects the 2 units.

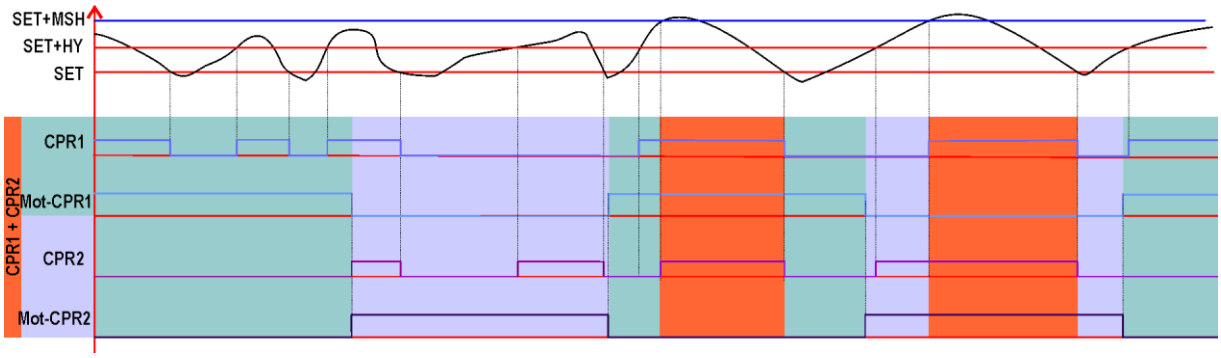
AUTOMATIC ROTATION

Via parameter **Mot** (0-255h; with 0, the function is excluded): **Hours per rotation**, the standard operating time of a machine is defined before carrying out the rotation.

Parameter **MM** (N÷Y): **the first machine activated in sequencing mode** defined which of the 2 machines connected will start first:
- **MM** = Y the controller immediately activates digital input **DI4**, start timer **Mot** and begins the adjustment;
- **MM** = N the controller waits 30s for the activation of **DI4**; if **DI4** is not activated within 30s, the controller activates digital input **DI4**, starts timer **Mot** and begins the adjustment.

NOTE: If MM =Y or MM = N for both machines, the sequencing is disabled and both machines are active
When the **Mot** elapses, the controller that activated **DI4**, deactivates it and waits 30s for it to be reactivated; if this does not happen, it reactivates it and causes timer **Mot** to restart.
The controller that detects that **DI4** is active, employs a higher differential compared to the standard one

The chart below shows the rotation logic:



Where CPR1 / CPR2 are the statuses of compressor 1/2.
Where Mot-CPR1 / Mot-CPR2 are the statuses of the timers referring to controllers 1/2.

The compressor without an active timer employs the MSH > Hy differential in order to intervene only if the temperature is far higher than the operating temperature.

Whenever a controller detects that **ID4** is not active, it activates it and starts the **Mot** timer.
Once timer **Mot** has expired, controller releases **ID4** and waits for it to be activated externally.

If this takes place within 30s, the controller loads the **MSH** differential and controls the temperature on **SET** (cut out) and **SET**+**MSH** (cut in).
If this does not happen within 30s, the **Mot** timer is reactivated and the controller keeps on controlling the temperature on **SET** (cut out) and **SET**+**HY** (cut in).
The following alarms:

a. High pressure
b. Low pressure
c. Phase sequence

Deactivate **ID4** and prevent it from being activated by the controller.

SUMMARY OF PARAMETERS

MM	Main machine	no(0) - yES(1)
Mot	Machine active maximum time	0 - 255 (hours)
MSH	Differential for machine in stand-by	°C[Hy ÷ 25.5] °F[Hy ÷ 45]
i4F	Digital input 4 function	nu(0) - SE(1)
i4P	Digital input 4 polarity	OP(0) - CL(1)

26. TESTING MODE

The testing mode can be activated:

1. only with the controller set to **ON**
2. by pressing **DOWN + ONF for at least 5 seconds**.

In testing mode, one must consider the safety alarms coming from the tool, namely:

1. High pressure switch
2. Low pressure switch
3. Flow alarm
4. Phase sequence alarm
5. SUCTION alarm

Here below is the modified sequence for the activation and deactivation of the devices during the various testing steps.

Step 0:

1. No active load
2. The word "**tSt**" is flashing on the display, which means you are in the testing procedure.

Step 1:

3. Activation of the evaporator / pump fan in the "Fan always on" mode.
4. The word "**FAn**" is flashing on the display, which indicates the forcing of the **evaporator / pump fan**
5. Deactivation of all the other devices

Step 2:

1. **If the fan is in temperature or pressure control mode**, analogue output AO1 is forced to 100%. Otherwise go to step 3.
2. The word "**Cnd**" is flashing on the display, which indicates the forcing of the **condenser fan**

Step 3:

1. Activation of the compressor by ignoring the **Minimum compressor switch-off time**, **Minimum time between two compressor start-ups**.
2. Activation of the evaporator / pump fan in the "Fan always on" mode.
3. Activation of the condenser fan at 100%
4. The word "**CPr**" is flashing on the display, which indicates the forcing in **cooling mode**

Step 4:

1. Deactivation of the compressor by ignoring the **Minimum compressor start-up time**, **Minimum time between two compressor start-ups**.
2. Deactivation of the condenser fan
3. Activation of the heating element
4. The word "**Htr**" is flashing on the display, which indicates the forcing in **heating mode**

Step 5:

Exit from the testing procedure and return to normal operation

If you stay in a step for ≥ than 30 min or if the controller is restarted, you will automatically leave the **testing procedure**.
The activation and deactivation of the devices will correspond to the one indicated in the various steps, both in the event of an increase and decrease associated with them during the testing.

27. BMS

The serial port can be used to read the variables and setup parameters via a supervision system based on an RTU modbus protocol.
The speed of the serial port can be set between 9600, 19200 Baud/s by changing parameter "**br**".

SUMMARY OF PARAMETERS

br	Baud Rate selection	96(0) - 192(1)

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