

AKO-14545 AKO-14545-C

5-stage compressor racks +
2 converter outputs

User Manual

**AKO**

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AKO Electromecánica thanks and congratulates you for purchasing our product, in whose development and manufacture the most innovative technology has been used, as well as strict production and quality control processes.

Our commitment to satisfy our customers and our continuous efforts to improve every day can be seen in the various quality certifications we have obtained.

This is a high performance, high technology product. The operation and final performance of the equipment depend on proper planning, installation, configuration and commissioning. Read this manual carefully before installation, and always follow its instructions. Only qualified personnel should install or perform technical assistance on this product.

This product is designed to be used in the applications described in the product manual. AKO Electromecánica gives no guarantee of its operation in any use not foreseen in the manual, and is not responsible for any damage resulting from improper use, configuration, installation or commissioning.

It is the responsibility of the installer and the customer to comply with and ensure others comply with all regulations applicable to installations incorporating our products. AKO Electromecánica is not responsible for any damage caused by non-compliance with regulations. Follow strictly the instructions given in this manual.

To maximise the service life of our equipment, these recommendations should be followed:

Do not expose electronic equipment to dust, dirt, water, rain, humidity, high temperatures, chemicals or corrosive substances of any sort.

Do not submit the equipment to blows or vibrations nor try to manipulate it differently from shown in the manual.

Never exceed the specifications and limitations indicated in the manual.

Always respect the specified ambient working and storage conditions.

During and after installation, avoid leaving loose, broken, unprotected or damaged wiring, since they might constitute a risk for the equipment and its users.

AKO Electromecánica reserves the right to make any non-metrology modification to the documentation or the equipment without previous notice.

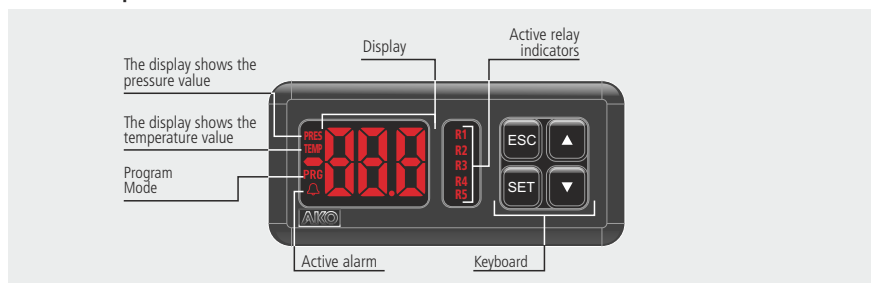
1- Precautions

- Using the equipment without following the manufacturer's instructions may affect the device's safety requirements.
- The unit must be installed in a location protected from vibrations, water and corrosive gases, where the ambient temperature does not exceed that shown in the technical data.
- To ensure a correct reading, the probe must be located away from external effects.
- The power supply circuit must be provided with a main switch rated at least 2 A, 230 V, located close to the equipment. The cables will enter through the back and should be type H05VV-F or H05V-K.
- The gauge will depend on local regulations, but should in no case be less than 1 mm².
- The wiring cables for the contact relays must have a section of 2.5 mm².

2.- Versions and part numbers

MODELS	POWER SUPPLY	PROBES	DIGITAL INPUTS	ANALOGUE OUTPUTS	RELAYS	COMMUNICATION
AKO-1454S	90-240 V	2 x 0-5 V / 4-20 mA / NTC + 1 x NTC	Up to 6	2 x 0-10 V / 4-20 mA (inverter controls)	5	NO
AKO-1454S-C	90-240 V	2 x 0-5 V / 4-20 mA / NTC + 1 x NTC	Up to 6	2 x 0-10 V / 4-20 mA (inverter controls)	5	YES












3.- Description



3.1.- Keypad functions

- ESC** In the programming menu, exit without saving parameter, return to previous level or exit programming.
- SET** By pressing this key for 1 second the probe display units change (according to parameter C09). Pressing for 10 seconds goes to the programming menu. In the programming menu, go to the level displayed or accept the new value while setting a parameter.
- ▲** By pressing this key for 1 second probe 2 is displayed for 5 seconds (or probe 1, according to parameter P02). By pressing a second time the probe ambient temperature value will be shown (only if I07 or I08=3). In the programming menu, allows you to scroll through the various levels or, during the setting of a parameter, to change the value.
- ▼** Pressing this key returns the unit to its standard operation after an alarm which requires a reset (the causes which triggered the alarm must have disappeared). In programming menu, allows you to scroll through the various levels or, during the setting of a parameter, to change the value.

3.2.- Display messages

	Flashing 0: Access code (Password) request You must enter the access code configured on L5 to execute the requested function (P. 23).
	Probe 1, 2 or 3 faulty (open circuit, crossover or temperature outside the probe limits; NTC : -50 To 99 °C; PTC : -50 To 150 °C). (Activates alarm relay)
	Clock battery discharged or clock deprogrammed (Activates alarm relay) (P. 16)
	Low pressure alarm due to probe 1 (Activates alarm relay) (P. 16)
	High pressure alarm due to probe 2 (Activates alarm relay) (P. 16)
	Thermal alarm inputs 1 to 5 (Activates alarm relay and stops the output associated to the relevant thermal) (P. 16)
	Severe external alarm activated due to digital input I5 or I6 (According to parameters I07 and I08) (Activates alarm relay and stops compressors and fans) (P. 16)
	Low pressure alarm due to digital input I5 or I6 (According to parameters I07 and I08) (Activates alarm relay and stops compressors and fans) (P. 15)
	High pressure alarm due to digital input I5 or I6 (According to parameters I07 and I08) (Activates alarm relay, stops compressors and activates fans) (P. 15)
	Regulation remotely stopped due to digital input I5 or I6; all stages/compressors are disconnected. (According to parameters I07 and I08) (Does not activate alarm relay) (P. 17)
	Pump down detained due to time (According to parameter E09) (Does not activate alarm relay) (P. 16)

4- Inicio rápido

The unit has a wizard that **configures the unit's parameters and assigns the input and output functions** according to the installation type chosen.

When connecting the power supply for the first time, the Configuration Wizard will start, displaying the message **INI** on screen. Follow the 4 steps detailed below and the unit will be ready to operate:



By using keys ▲ and ▼, select the most suitable option according to the installation type in accordance with the "WIZARD" table on page 7 and press **SET**. The wizard **configures the equipment parameters and assigns the input and output functions** according to the installation type chosen.



Select the refrigerant gas type used from amongst the following options:

0=R134a 1=R404a 2=R717a 3=R22 4=R410a 5=R507a 6=R744
7=R407a 8=R407f 9=R1234y 10=R448a 11=R449a 12=R450a



Select the primary and secondary display units from amongst the following options:

0=bar-°C; 1=psi-°F; 2=psi-°C; 3=bar-°F; 4=°C-bar;
5=°F-psi; 6=°C-psi; 7=°F-bar



Configure the rest of the parameters to their default value? :

0=No, the configuration is kept for all the parameters except for C01, C02, C04, C05 C06, C08 and C09.

1=Yes, all the parameters are configured to their default value (see parameters table)
(This option does not affect parameters C01, C02, C04, C05 C06, C08 and C09)

In order to start the wizard again, disconnect the unit's power supply, reconnect it and, during the subsequent 8 seconds, press the key sequence ▲, ▼, **SET**.

4.1.- "WIZARD" table description

The "WIZARD" annex table is divided into 3 groups of columns.

The first group describes the different types of installation (no. of compressors and fans, whether they have a converter, etc.) associated to their **INI** option.

Installation

INI	Stages by compressor		Compressors with inverter		
	Compressors without inverter	Fans without inverter	Fans with inverter		
1	1	1	-	-	
2	1	2	-	-	
3	1	3	-	-	

The second group specifies the function assigned to each relay depending on the **INI** option selected.

Relays

Relays R1 to R5

OUTPUTS				
R1	R2	R3	R4	R5
CV	C2	C2a	FV	AL
CV	C2	C2a	C2b	FV
CV	C2	C3	FV	AL

Function assigned to each relay depending on the **INI** option selected*

The third group specifies the function assigned to each digital input depending on the **INI** option selected.

Inputs

Inputs I1 to I6

INPUTS					
I1	I2	I3	I4	I5	I6
T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.
T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.
T-VAR-C1	T-C2	T-C3	T-VAR-F	L.P.	H.P.
T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.

Function assigned to each input depending on the **INI** option selected*

4.2.- Legend



Compressors without inverter



Number of stages per compressor



Compressor with inverter



Fans without inverter



Fans with inverter

FUNCTION OF THE OUTPUTS

CV:	RUN inverter output (compressor)	Cxa, Cxb, Cxc:	Output stages 1, 2 and 3 of compressor x
FV:	RUN inverter output (fans)	Vx:	Output fan without inverter
Cx:	Output compressors without inverter	AL:	Alarm output















FUNCTION OF THE INPUTS

T-VAR-C1:	Thermal input frequency inverter (compressor)	T-Vx:	Thermal input fan
T-VAR-F:	Thermal input frequency inverter (fans)	H.P.:	Input high pressure switch
T-Cx:	Thermal input compressor	L.P.:	Input low pressure switch

x: Compressor or fan no.

a, b, c: Compressor stages

4.3.- "WIZARD" table

INI						OUTPUTS					INPUTS					
						R1	R2	R3	R4	R5	I1	I2	I3	I4	I5	I6
																
1	1	1	-	-	-	C1	-	-	-	AL	T-C1	-	-	-	L.P.	H.P.
2	1	2	-	-	-	C1	C1a	-	-	AL	T-C1	-	-	-	L.P.	H.P.
3	1	3	-	-	-	C1	C1a	C1b	-	AL	T-C1	-	-	-	L.P.	H.P.
4	1	4	-	-	-	C1	C1a	C1b	C1c	AL	T-C1	-	-	-	L.P.	H.P.
5	2	1	-	-	-	C1	C2	-	-	AL	T-C1	T-C2	-	-	L.P.	H.P.
6	2	2	-	-	-	C1	C1a	C2	C2a	AL	T-C1	T-C2	-	-	L.P.	H.P.
7	3	1	-	-	-	C1	C2	C3	-	AL	T-C1	T-C2	T-C3	-	L.P.	H.P.
8	4	1	-	-	-	C1	C2	C3	C4	AL	T-C1	T-C2	T-C3	T-C4	L.P.	H.P.
9	5	1	-	-	-	C1	C2	C3	C4	C5	T-C1	T-C2	T-C3	T-C4	T-C5	H.P.
 + 																
10	0	-	1	-	-	CV	-	-	-	AL	T-VAR-C1	-	-	-	L.P.	H.P.
11	1	1	1	-	-	CV	C2	-	-	AL	T-VAR-C1	T-C2	-	-	L.P.	H.P.
12	1	2	1	-	-	CV	C2	C2a	-	AL	T-VAR-C1	T-C2	-	-	L.P.	H.P.
13	1	3	1	-	-	CV	C2	C2a	C2b	AL	T-VAR-C1	T-C2	-	-	L.P.	H.P.
14	1	4	1	-	-	CV	C2	C2a	C2b	C2c	T-VAR-C1	T-C2	-	-	L.P.	H.P.
15	2	1	1	-	-	CV	C2	C3	-	AL	T-VAR-C1	T-C2	T-C3	-	L.P.	H.P.
16	2	2	1	-	-	CV	C2	C2a	C3	C3a	T-VAR-C1	T-C2	T-C3	-	L.P.	H.P.
17	3	1	1	-	-	CV	C2	C3	C4	AL	T-VAR-C1	T-C2	T-C3	T-C4	L.P.	H.P.
18	4	1	1	-	-	CV	C2	C3	C4	C5	T-VAR-C1	T-C2	T-C3	T-C4	T-C5	H.P.
																
19	-	-	-	-	✓	FV	-	-	-	AL	T-VAR-F	-	-	-	L.P.	H.P.
 + 																
20	1	1	-	-	✓	C1	FV	-	-	AL	T-C1	T-VAR-F	-	-	L.P.	H.P.
21	1	2	-	-	✓	C1	C1a	FV	-	AL	T-C1	T-VAR-F	-	-	L.P.	H.P.
22	1	3	-	-	✓	C1	C1a	C1b	FV	AL	T-C1	T-VAR-F	-	-	L.P.	H.P.
23	1	4	-	-	✓	C1	C1a	C1b	C1c	FV	T-C1	T-VAR-F	-	-	L.P.	H.P.
24	2	1	-	-	✓	C1	C2	FV	-	AL	T-C1	T-C2	T-VAR-F	-	L.P.	H.P.
25	2	2	-	-	✓	C1	C1a	C2	C2a	FV	T-C1	T-C2	T-VAR-F	-	L.P.	H.P.
26	3	1	-	-	✓	C1	C2	C3	FV	AL	T-C1	T-C2	T-C3	T-VAR-F	L.P.	H.P.
27	4	1	-	-	✓	C1	C2	C3	C4	FV	T-C1	T-C2	T-C3	T-C4	T-VAR-F	H.P.
 +  + 																
28	0	-	1	-	✓	CV	FV	-	-	AL	T-VAR-C1	T-VAR-F	-	-	L.P.	H.P.
29	1	1	1	-	✓	CV	C2	FV	-	AL	T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.
30	1	2	1	-	✓	CV	C2	C2a	FV	AL	T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.
31	1	3	1	-	✓	CV	C2	C2a	C2b	FV	T-VAR-C1	T-C2	T-VAR-F	-	L.P.	H.P.
32	2	1	1	-	✓	CV	C2	C3	FV	AL	T-VAR-C1	T-C2	T-C3	T-VAR-F	L.P.	H.P.
33	3	1	1	-	✓	CV	C2	C3	C4	FV	T-VAR-C1	T-C2	T-C3	T-C4	T-VAR-F	H.P.

INI						INPUTS					OUTPUTS					
						R1	R2	R3	R4	R5	I1	I2	I3	I4	I5	I6
34	-	-	-	1	-	V1	-	-	-	AL	T-V1	-	-	-	L.P.	H.P.
35	-	-	-	2	-	V1	V2	-	-	AL	T-V1	T-V2	-	-	L.P.	H.P.
36	-	-	-	3	-	V1	V2	V3	-	AL	T-V1	T-V2	T-V3	-	L.P.	H.P.
37	-	-	-	4	-	V1	V2	V3	V4	AL	T-V1	T-V2	T-V3	T-V4	L.P.	H.P.
38	-	-	-	5	-	V1	V2	V3	V4	V5	T-V1	T-V2	T-V3	T-V4	T-V5	H.P.
39	1	1	-	1	-	C1	V1	-	-	AL	T-C1	T-V1	-	-	L.P.	H.P.
40	1	1	-	2	-	C1	V1	V2	-	AL	T-C1	T-V1	T-V2	-	L.P.	H.P.
41	1	1	-	3	-	C1	V1	V2	V3	AL	T-C1	T-V1	T-V2	T-V3	L.P.	H.P.
42	1	1	-	4	-	C1	V1	V2	V3	V4	T-C1	T-V1	T-V2	T-V3	T-V4	H.P.
43	1	2	-	1	-	C1	C1a	V1	-	AL	T-C1	T-V1	-	-	L.P.	H.P.
44	1	2	-	2	-	C1	C1a	V1	V2	AL	T-C1	T-V1	T-V2	-	L.P.	H.P.
45	1	2	-	3	-	C1	C1a	V1	V2	V3	T-C1	T-V1	T-V2	T-V3	L.P.	H.P.
46	1	3	-	1	-	C1	C1a	C1b	V1	AL	T-C1	T-V1	-	-	L.P.	H.P.
47	1	3	-	2	-	C1	C1a	C1b	V1	V2	T-C1	T-V1	T-V2	-	L.P.	H.P.
48	1	4	-	1	-	C1	C1a	C1b	C1c	V1	T-C1	T-V1	-	-	L.P.	H.P.
49	2	1	-	1	-	C1	C2	V1	-	AL	T-C1	T-C2	T-V1	-	L.P.	H.P.
50	2	1	-	2	-	C1	C2	V1	V2	AL	T-C1	T-C2	T-V1	T-V2	L.P.	H.P.
51	2	1	-	3	-	C1	C2	V1	V2	V3	T-C1	T-C2	T-V1	T-V2	T-V3	H.P.
52	2	2	-	1	-	C1	C1a	C2	C2a	V1	T-C1	T-C2	T-V1	-	L.P.	H.P.
53	3	1	-	1	-	C1	C2	C3	V1	AL	T-C1	T-C2	T-C3	T-V1	L.P.	H.P.
54	3	1	-	2	-	C1	C2	C3	V1	V2	T-C1	T-C2	T-C3	T-V1	T-V2	H.P.
55	4	1	-	1	-	C1	C2	C3	C4	V1	T-C1	T-C2	T-C3	T-C4	T-V1	H.P.
56	0	-	1	1	-	CV	V1	-	-	AL	T-VAR-C1	T-V1	-	-	L.P.	H.P.
57	0	-	1	2	-	CV	V1	V2	-	AL	T-VAR-C1	T-V1	T-V2	-	L.P.	H.P.
58	0	-	1	3	-	CV	V1	V2	V3	AL	T-VAR-C1	T-V1	T-V2	T-V3	L.P.	H.P.
59	0	-	1	4	-	CV	V1	V2	V3	V4	T-VAR-C1	T-V1	T-V2	T-V3	T-V4	H.P.
60	1	1	1	1	-	CV	C2	V1	-	AL	T-VAR-C1	T-C2	T-V1	-	L.P.	H.P.
61	1	1	1	2	-	CV	C2	V1	V2	AL	T-VAR-C1	T-C2	T-V1	T-V2	L.P.	H.P.
62	1	1	1	3	-	CV	C2	V1	V2	V3	T-VAR-C1	T-C2	T-V1	T-V2	T-V3	H.P.
63	1	2	1	1	-	CV	C2	C2a	V1	AL	T-VAR-C1	T-C2	T-V1	-	L.P.	H.P.
64	1	2	1	2	-	CV	C2	C2a	V1	V2	T-VAR-C1	T-C2	T-V1	T-V2	L.P.	H.P.
65	1	3	1	1	-	CV	C2	C2a	C2b	V1	T-VAR-C1	T-C2	T-V1	-	L.P.	H.P.
66	2	1	1	1	-	CV	C2	C3	V1	AL	T-VAR-C1	T-C2	T-C3	T-V1	L.P.	H.P.
67	2	1	1	2	-	CV	C2	C3	V1	V2	T-VAR-C1	T-C2	T-C3	T-V1	T-V2	H.P.
68	3	1	1	1	-	CV	C2	C3	C4	V1	T-VAR-C1	T-C2	T-C3	T-C4	T-V1	H.P.

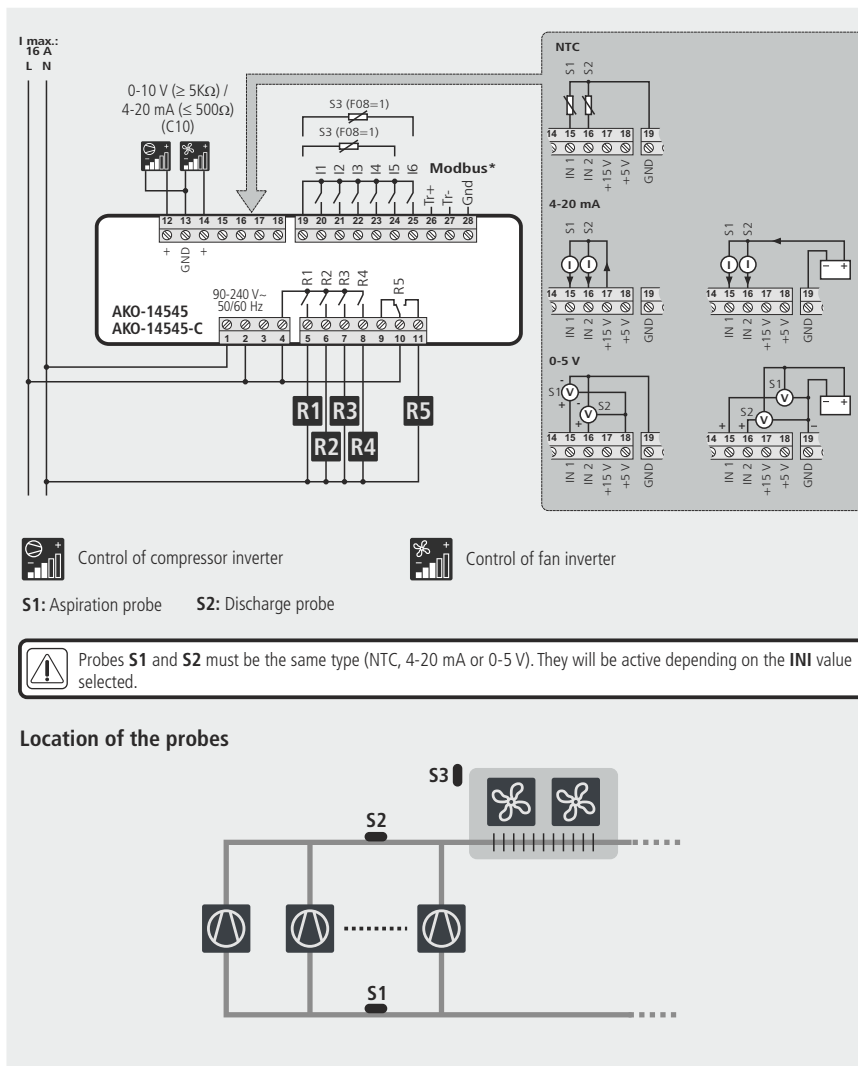
L.P.

In the case of floating condensation (F08=1), the highlighted inputs are configured as inputs for the ambient temperature probe.

H.P.

5.- Wiring

The function of each relay output or digital input depends on the option chosen in the INI wizard (See page 5).

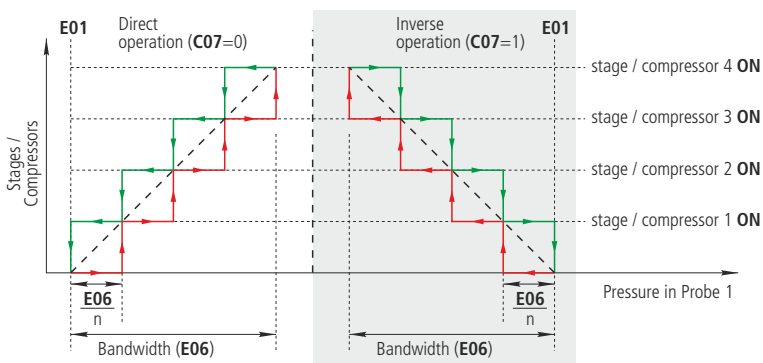


6.- Location of the probes

6.1.- Proportional mode

WITHOUT FREQUENCY CONVERTER

The controller activates (red line) or deactivates (green line) the different stages/compressors available in a linear manner depending on the reading obtained in **probe 1** until the Set Point (E01) is reached again, as shown in the following figure.

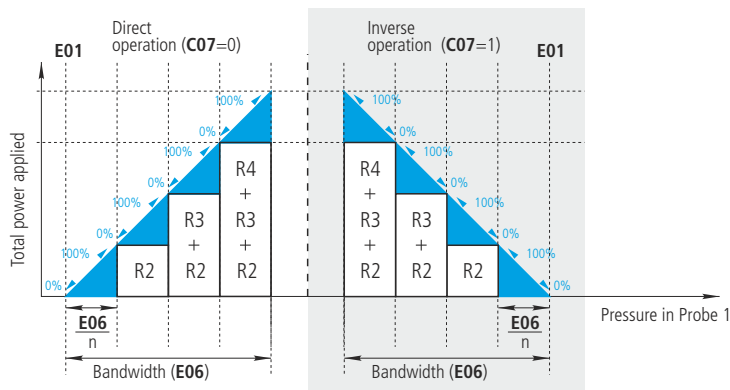


n: Number of stages/compressors available

WITH FREQUENCY CONVERTER

If there is a frequency converter, the frequency converter modulates the power of **compressor 1** between 0 and 100% (blue zone). If demand increases, the following compressor or stage (without converter) is added, again modulating the power of **compressor 1** using the converter, and so on.

This method allows modulating the total power available using just one frequency converter.



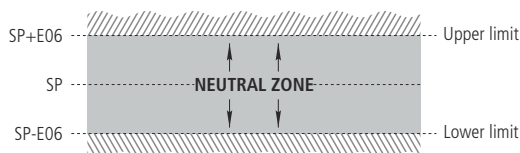
n: Number of stages/compressors available

In both cases, the delays **t01** to **t04** must be accounted for.

6.2.- Neutral zone mode

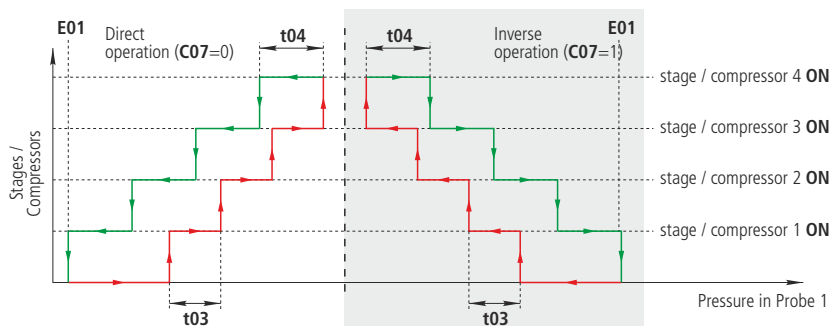
WITHOUT FREQUENCY CONVERTER

In this mode, a neutral zone is defined, whose lower limit is the Set Point minus the bandwidth, and whose upper limit is the Set Point plus the bandwidth. While the reading of probe 1 remains in that zone, no stages or compressors are connected or disconnected.



If the upper limit is exceeded, the controller activates the different stages/compressors separated by the interval defined in parameter **t03** (red line) until returning to the neutral zone.

If the lower limit is exceeded, the controller deactivates the different stages/compressors separated by the interval defined in parameter **t04** (green line) until returning to the neutral zone.



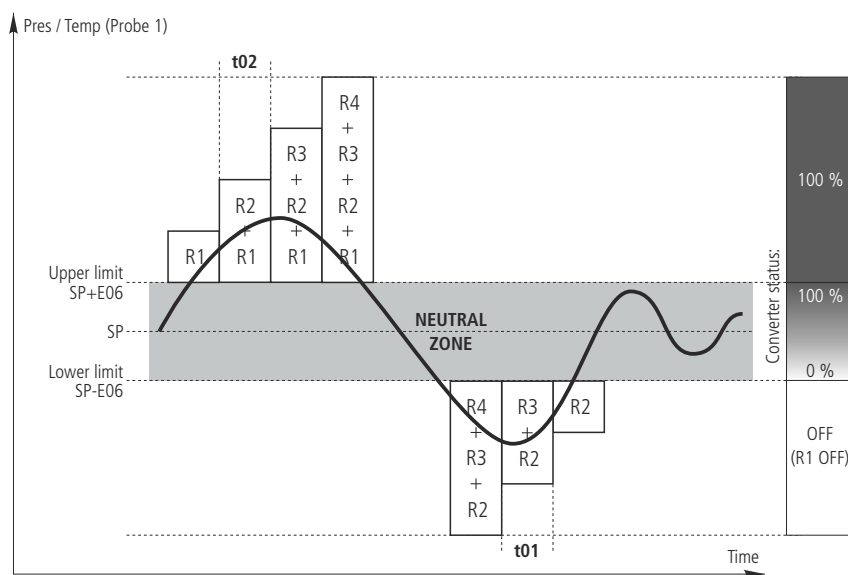
In order to deactivate a stage/compressor, the interval **t01** must have passed, and interval **t02** defines the minimum interval between starts of the same stage/compressor.

WITH FREQUENCY CONVERTER

Operation is the same as in the previous point, but modulating the power of compressor 1 with the converter while it remains in the neutral zone using a **PID** control.

Near the upper limit, the compressor operates at its maximum capacity, and if said limit is exceeded, more stages/compressors are added, in accordance with the interval defined in **t02**, until returning to the neutral zone.

Near the lower limit, the compressor operates at its minimum capacity, and if said limit is exceeded, it stops. The rest of the stages/compressors will stop, in accordance with the interval programmed in **t01**, until re-entering the neutral zone, upon which compressor 1 activates again at its minimum capacity.



Example with the type of compressor rotation configured as sequential (E04=1)

6.3.- Pump Down

It is only available if the type of operation is direct (**C07=0**).

When the pressure reaches the Set Point value (**E01**) in probe 1, the last stage/compressor remaining in operation does not stop; it continues to reduce the pressure until reaching the value configured in parameter **E08**.

In the event of a failure, if the value of **E08** is not reached, the controller will stop the compressor once the security interval defined in **E09** has passed, displaying the message "**PdA**" (an informative message that does not affect the unit's operation).

For this function to be active, the parameter **E08** must be configured below the Set Point (**E01**).

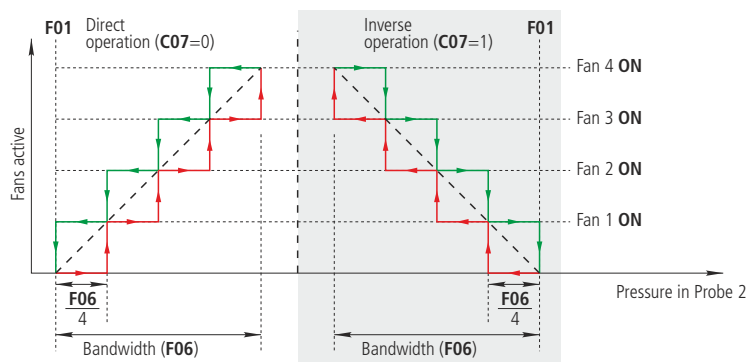
7.- Fan control

7.1.- Proportional mode

WITHOUT FREQUENCY CONVERTER

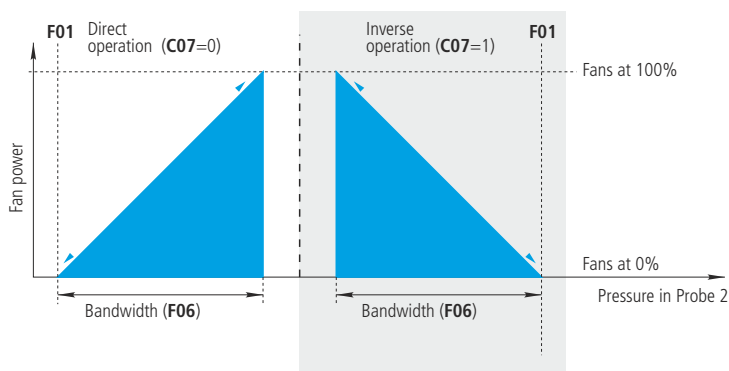
The controller activates (red line) or deactivates (green line) the different fans available in a linear manner depending on the reading obtained in **probe 2** until the Set Point (E01) is reached again, as shown in the following figure.

The delays **t05** to **t08** must be accounted for.



WITH FREQUENCY CONVERTER

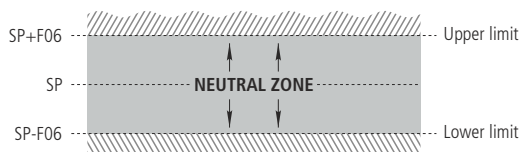
If there is a frequency converter, the frequency converter modulates the power of the fans between 0 and 100%.



7.2.- Neutral zone mode

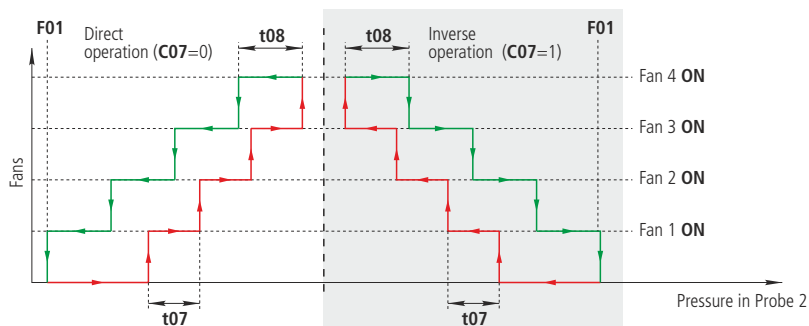
WITHOUT FREQUENCY CONVERTER

In this mode, a neutral zone is defined, whose lower limit is the Set Point minus the bandwidth, and whose upper limit is the Set Point plus the bandwidth. While the reading of probe 2 remains in that zone, no fans are connected or disconnected.



If the upper limit is exceeded, the controller activates the different fans separated by the interval defined in parameter **t07** (red line) until returning to the neutral zone.

If the lower limit is exceeded, the controller deactivates the different fans separated by the interval defined in parameter **t08** (green line) until returning to the neutral zone.



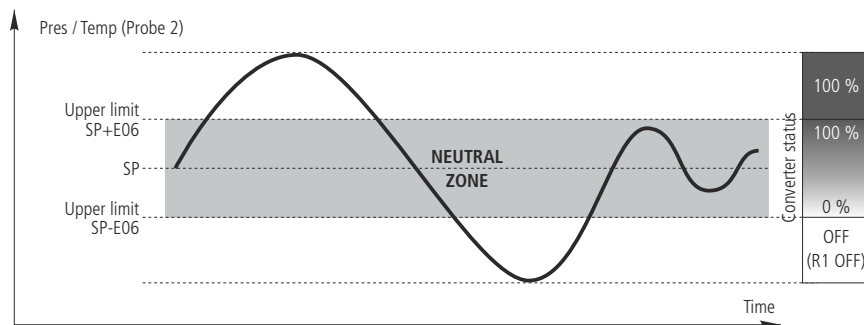
In order to deactivate a fan, the interval **t05** must have passed, and interval **t06** defines the minimum interval between starts of the same stage/compressor.

WITH FREQUENCY CONVERTER

Operation is the same as in the previous point, but modulating the power of the fans with the converter while it remains in the neutral zone using a **PID** control.

Near the upper limit, the fans operate at their maximum capacity, and if said limit is exceeded, the capacity is kept at its maximum until returning to the neutral zone.

Near the lower limit, the fans operate at their minimum capacity, and if said limit is exceeded, they stop until returning to the neutral zone, upon which they activate again at their minimum capacity.



7.3.- Floating condensation

The controller modulates the evaporation Set Point taking into account the ambient temperature (requiring connecting probe 3) and the power of the compressors.

This type of control improves the COP (the relationship between cooling power and consumed electrical energy) and hence increases the energy performance of the installation.



This mode is only valid if the fans of the condenser are controlled, with or without a frequency converter.

7.4- Alarms



IMPORTANT: The alarms that cause compressors and fans to stop will do so in a sequential manner, with a delay of 5 seconds between stops.

LOW AND HIGH PRESSURE ALARM DUE TO DIGITAL INPUT

When the digital input I5 or I6 is activated, the message HPA (High) or LPA (Low) is shown on screen, the alarm relay is activated (if available) and the compressors are stopped.

If the alarm is due to **low pressure**, the fans stop; if it is due to **high pressure**, the fans activate regardless of parameter **F07**.

If the cause that triggered the alarm disappears, the installation returns to its standard operation.

Parameter **A09** defines the number of **high-pressure alarms allowed per hour**. If this value is exceeded, the unit must be manually reset by pressing the ▼ key in order for it to return to its standard operation, once the cause that triggered the alarm has disappeared.

This requires the parameters **I07** or **I08** to be set to 0 or 1.

When the readings return to their normal values, the alarm relay deactivates but the ⚠ indicator remains on until the ▼ key is pressed.





LOW AND HIGH PRESSURE ALARM DUE TO PROBES 1 AND 2

If the reading in probe 1 reaches the value set for parameter **A03**, the message **ALL** (Low pressure) is displayed on screen and the alarm relay activates (if available).

This alarm differential is established in parameter **A04**.

If the reading in probe 1 reaches the value set for parameter **A05**, the message **ALH** (High pressure) is displayed on screen and the alarm relay activates (if available).

This alarm differential is established in parameter **A06**.

When the readings return to their normal values, the alarm relay deactivates but the  indicator remains on until the  key is pressed.



PROTECTION ALARMS

If one of the thermal protections goes off (digital inputs **I1** to **I5**, according to the configuration), the message **At1** ... is displayed on screen **At5**, the associated element (compressor or fan) stops and the alarm relay activates (if available).

Once the protection is reset, the installation returns to its standard operation, but the alarm relay remains activated until the  key is pressed.



SEVERE EXTERNAL ALARM



When the digital input configured as a severe external alarm (**I07** or **I08=4**) is activated, the screen displays the message **AES**, the compressors and fans stop and the alarm relay activates.

Once the cause that triggered the alarm disappears, the installation returns to its standard operation, but the  indicator remains activated until the  key is pressed.



PROBE 1, 2 or 3 ERROR

If an error occurs in probes 1, 2 or 3 (disconnection, cross-over or probe out of range), the screen displays the messages **E1**, **E2** or **E3** respectively, the alarm relay activates and the compressors and fans go on to operate according to parameters **A01** and **A02**.

Once the cause that triggered the alarm disappears, the installation returns to its standard operation, but the  indicator remains activated until the  key is pressed.



DEPROGRAMMED CLOCK ALARM

If the unit remains without electrical supply for a period longer than 6 hours, or upon its first start-up, the screen displays the message **Ar**, indicating that the internal clock is deprogrammed. The unit will continue its standard operation, but if the energy save mode has been activated, it will not start. In order to set the date and time again, adjust parameters **r01** to **r05**. Activates the alarm relay.



PUMP DOWN ALARM STOPPED DUE TO TIME

If, during pump down, the maximum interval configured in **E09** passes before the stop value specified by **E08** is reached, the last stage will stop and the message **PdA** will be displayed. Does not activate the alarm relay.



Alarm delay

These delays prevent the display of specific alarms while allowing the unit to recover normal operation after certain events.

- Delays in start-up (**A08**): Delays the activation of the alarms upon receiving power supply (start-up or after a fault in the power supply). This allows starting up the installation avoiding constant alarm statuses.
- Alarm delay (**A07**): It delays the activation of the high and low pressure alarms (**A03** and **A05**) from the time that the programmed values are reached.
- Turn-on delay time of alarms due to digital input 5 (**I09**): It delays the activation of activated alarms due to digital input 5. The type of alarm to be activated depends on the configuration of parameter **I07**. It does not take effect if parameter **I07** is set to 2 (Thermal alarm).
- Turn-on delay time of alarms due to digital input 6 (**I10**): It delays the activation of activated alarms due to digital input 6. The type of alarm to be activated depends on the configuration of parameter **I08**. It does not take effect if parameter **I08** is set to 2 (Thermal alarm).

7.5.- Remote disconnection

This function allows stopping / starting regulation with an external signal via the digital input 5 or 6.

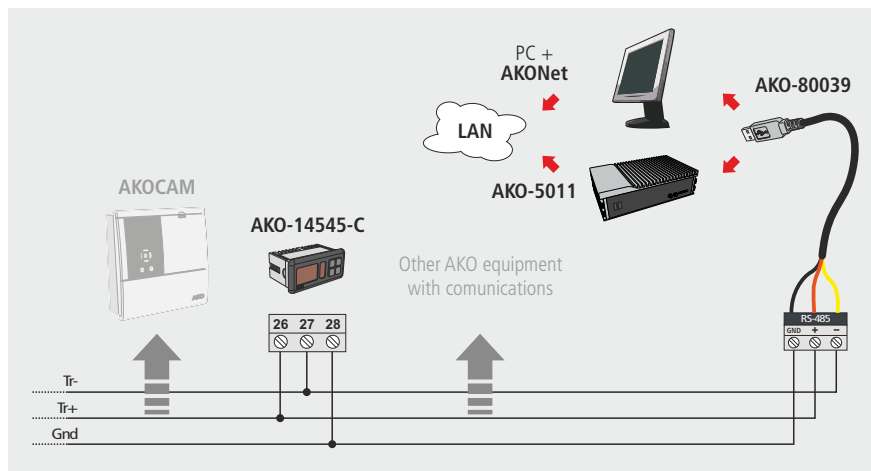
The digital input 5 or 6 must be configured as a remote disconnection (**I07** or **I08=5**).

When stopping or starting regulation, the compressors / stages and fans will stop or start in accordance with the timings set in parameters **t01** to **t08**.

8.- Connectivity

The **AKO-14545-C** model has a port for connection of RS485 (MODBUS) data, that allows remotely managing them using a PC with the **AKONet** software or an **AKO-5011** server.

A different address must be assigned to each unit on the same network. This address is defined by parameter **P5**.



9.- Parameter setup

Through the programming menu users can set different parameters to adjust the operation of the controller to the needs of their installation.

9.1.- Programming Menu

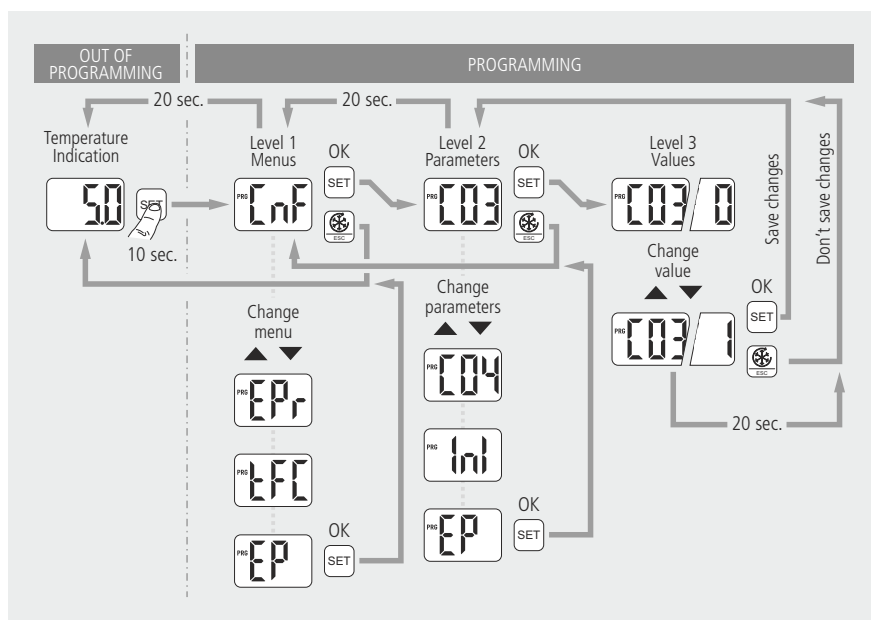
It allows changing the unit's operating parameters.

To access the programming menu, press the **SET** button for 10 seconds, or until the "PRG" appears on the screen.



IMPORTANT: If the password function has been configured, the system will demand entering the password programmed in **L5**. If the entered password is not correct, the unit will go back to showing the temperature.

After 20 seconds with no key being pressed, the equipment will return to the previous level. If you are on level 3, the changes will not be saved.



9.2.- Parameters

The unit's operation parameters are organized into groups or families according to their function.

The **Def.** column shows factory-set default parameters.

The pressure values featured on the table are expressed in **bar** and those for temperature in **°C**. If the wizard meanwhile selects another set of units (parameter **C09**), the unit will make the conversion automatically.



IMPORTANT: C01, C02, C04, C05, C06, C08 and C09 are read-only parameters, editable using the INI wizard only.

Level 1.- INSTALLATION CONFIGURATION



Level 2

	Description	Units	Min	Def	Max.
C01	Total number of compressors (with or without inverter)		-	-	-
C02	Number of stages per compressor		-	-	-
C03	Polarity of the capacity reduction contact 0=Active when closing the contact; 1=Active when opening the contact		0	0	1
C04	Compressor 1 with frequency inverter 0=No; 1=Yes		-	-	-
C05	Total number of fans (1 inverter only is considered with inverter)		-	-	-
C06	Fan control type 0=ON/OFF; 1=Frequency inverter		-	-	-
C07	Operation type 0=Direct; 1=Inverse		0	0	1
C08	Refrigerant gas type 0=R134a 1=R404a 2=R717a 3=R22 4=R410a 5=R507a 6=R744 7=R407a 8=R407f 9=R1234y 10=R448a 11=R449a 12=R450a		-	-	-
C09	Display units (Primary-Secondary) 0=bar-°C 1=psi-°F 2=psi-°C 3=bar-°F 4=°C-bar 5=°F-psi 6=°C-psi 7=°F-bar		-	-	-
C10	Frequency inverter output type 0=4-20 mA; 1=0-10 V		0	0	1
Ini	This indicates the configuration selected in the wizard (read only)		-	-	-
EP	Output to level 1				

Level 1.- EVAPORATION CONFIGURATION



Level 2

	Description	Units	Min	Def	Max.
E01	Pressure / evaporation temperature set point	bar	E03	5	E02
E02	Evaporation set point upper limit (It cannot be set above this limit)	bar	E03	75	75
E03	Evaporation set point lower limit (It cannot be set below this limit)	bar	-0.7	-0.7	E02
E04	Compressor rotation type: 0=Balancing, depending on the operation time 1=Sequential (the last in is the first out)		0	0	1
E05	Compressor control type: 0=Neutral zone; 1=Proportional		0	0	1
E06	Evaporation regulation bandwidth	bar	0.0	2.0	50
E07	Integral time (PID inverter control)	sec.	2	5	10
E08	Stop value for pump down (If C07=0)	bar	-0.7	0.1	*
E09	Maximum pump down time (If C07=0) (0= deactivated)	sec.x10	0	0	255
EP	Output to level 1				

* Depending on the compressor control type: Proportional=E01; Neutral zone=E01-E06.

Level 1.- CONDENSATION CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
F01	Condensation pressure / temperature set point	bar	F03	19	F02
F02	Condensation set point upper limit (It cannot be set above this limit)	bar	F03	75	75
F03	Condensation set point lower limit (It cannot be set below this limit)	bar	-0.7	-0.7	F02
F04	Fan rotation type: 0 =Balancing, depending on the operation time 1 =Sequential (the last in is the first out)		0	1	1
F05	Fan control type: 0 =Neutral zone; 1 =Proportional		0	0	1
F06	Condensation regulation bandwidth	bar	0.0	2.0	50
F07	For fans when the compressors stop 0 =No; 1 =Yes		0	0	1
F08	Floating condensation 0 =No; 1 =Yes		0	0	1
F09	Integral time (PID inverter control)	sec.	2	5	10
F10	Floating condensation minimum set point value (see remark 1)	°C	-50	28	99.9
F11	Condenser temperature delta	°C	6	12	20
EP	Output to level 1				

Level 1.- PROBE CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
P01	Probe type selection 0 =4-20 mA; 1 =0-5 V; 2 =NTC		0	0	2
P02	Probe to be displayed: 0 =Probe 1 (Aspiration) 1 =Probe 2 (Discharge); 2 =Probes 1 and 2 in carousel		0	0	2
P03	Value 4 mA / 0 V (according to P01) probe 1	bar	-60	-60	999
P04	Value 20 mA / 5 V (according to P01) probe 1	bar	-60	999	999
P05	Probe 1 calibration (Offset)	bar	-20	0	20
P06	Value 4 mA / 0 V (according to P01) probe 2	bar	-60	-60	999
P07	Value 20 mA / 5 V (according to P01) probe 2	bar	-60	999	999
P08	Probe 2 calibration (Offset)	bar	-20	0	20
P09	Calibration of the outside temperature probe for floating condensation	°C	-20	0	20
EP	Output to level 1				

Remark 1: The equivalent value in pressure is calculated depending on the refrigerant gas specified in the wizard.

Level 1.- DIGITAL INPUT CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
I01	Polarity digital input 1 (thermal stage 1): 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I02	Polarity digital input 2 (thermal stage 2): 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I03	Polarity digital input 3 (thermal stage 3): 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I04	Polarity digital input 4 (thermal stage 4): 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I05	Polarity digital input 5: 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I06	Polarity digital input 6: 0=Activates on closing contact; 1=Activates on opening contact		0	0	1
I07	Digital input 5 function: 0=Low pressure alarm 1=High pressure alarm 2=Thermal stage alarm 5 3=Ambient temperature probe 4=External alarm 5=Remote disconnection ON-OFF 6=Variation in the aspiration set point (E01) (see remark 2)		0	0	6
I08	Digital input 6 function: 0=Low pressure alarm 1=High pressure alarm 2=Thermal stage alarm 5 3=Ambient temperature probe 4=External alarm 5=Remote disconnection ON-OFF 6=Variation in the aspiration set point (E01) (see remark 2)		0	1	6
I09	Turn-on delay time of digital input 5 (not applicable if I07=2)	sec.	0	0	255
I10	Retardo de activación de la entrada digital 6 (No aplica si I08=2)	sec.	0	0	255
I11	Variation in the evaporation set point (new set point= E01+I11) (see remark 2)	bar	-20	0	20
I12	Duration of the variation in the evaporation set point (see remark 2)	min.	0	0	255
EP	Output to level 1				

Level 1.- ENERGY SAVING CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
S01	Start of energy saving - Day of the week: 0=Deactivated 1=Monday 2=Tuesday 3=Wednesday 4=Thursday 5=Friday 6=Saturday 7=Sunday 8=Monday to Sunday 9=Monday to Saturday 10=Monday to Friday 11=Saturday to Sunday		0	0	11
S02	Start of the energy saving - Hour (see remark 2)	h.	0	0	23
S03	Start of the energy saving - Minute (see remark 2)	min.	0	0	59
S04	Duration of the energy saving (see remark 2)	h.	0	0	24
S05	Variation in the evaporation set point during energy saving (E01+S05) (see remark 2)	bar	-20	0	20
EP	Output to level 1				

Remark 2: In the event of the energy saving and the variation in the set point per digital input being activated at the same time, the variation in the set point per digital input will always prevail.

Level 1.- TIMING CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
t01	Minimum operation time for a compressor	sec.x10	1	2	999
t02	Minimum disconnection time for a compressor	sec.x10	1	2	999
t03	Delay time between the compressor start-up/stage and the next one	sec.	1	30	999
t04	Delay time between the compressor stop/stage and the next one	sec.	1	10	999
t05	Minimum operation time for a fan	sec.x10	1	1	999
t06	Minimum disconnection time for a fan	sec.x10	1	1	999
t07	Delay time between the fan start-up and the next one	sec.	1	2	999
t08	Delay time between the fan stop and the next one	sec.	1	2	999
EP	Output to level 1				

Level 1.- CONFIGURATION OF PROTECTIONS AND ALARMS



Level 2	Description	Units	Min	Def	Max.
A01	Number of active compressor stages with error in probe 1		0	0	**
A02	Number of active fans or inverter % with error in probe 2	Without inverter	0	C05	C05
		With inverter	0	100%	100%
A03	Low pressure alarm in probe 1	bar	-0.7	0	75
A04	Low pressure alarm differential	bar	0.1	1.0	20
A05	High pressure alarm in probe 2	bar	-0.7	20	75
A06	High pressure alarm differential	bar	0.1	1.0	20
A07	Alarm delay after reaching the value	seg.	0	60	999
A08	Delay of temperature alarms in the start-up.	seg.	0	0	255
A09	High pressure alarm limit (per digital input) per hour without manual reset. (If I07 or I08=1) (0=deactivated) Once the limit has been exceeded a manual reset will be required for each new alarm.		0	0	255
EP	Output to level 1				

Level 1.- DATE AND TIME CONFIGURATION



Level 2	Description	Units	Min	Def	Max.
r01	Hour		00	00	23
r02	Minutes		00	00	59
r03	Day		1	1	31
r04	Month		1	1	12
r05	Year		00	15	99
EP	Output to level 1				

** The number of stages depends on the configuration selected in the wizard.

Level 1.- ACCESS AND INFORMATION CONTROL



Level 2

	Description	Units	Min	Def	Max.
P5	Address for units with communication		1	1	255
L5	Access code (Password)		0	0	999
PU	Programme version		-	-	-
Pr	Programme revision		1	-	-
EP	Output to level 1				

Level 1.- OPERATION TIMES



Level 2

	Description	Units	Min	Def	Max.
c1	This shows the operation time for the compressor or fan 1	horas x10	-	-	999
c2	This shows the operation time for the compressor or fan 2	horas x10	-	-	999
c3	This shows the operation time for the compressor or fan 3	horas x10	-	-	999
c4	This shows the operation time for the compressor or fan 4	horas x10	-	-	999
c5	This shows the operation time for the compressor or fan 5	horas x10	-	-	999
EP	Output to level 1				
EP	Programming output				

9.3.- Limits and default values of the pressure and temperature parameters according to units.

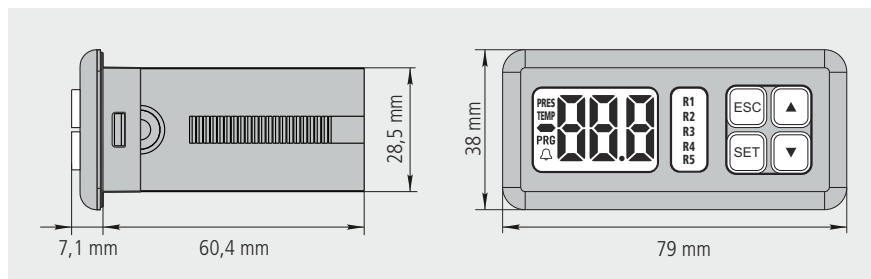
The following table shows the default values and the limits of the pressure and temperature parameters according to the display units defined by parameter **C09** during quick start (see page 5).

	MINIMUM				DEFAULT value				MAXIMUM			
	Pressure		Temp.		Pressure		Temp.		Pressure		Temp.	
	bar	psi	°C	°F	bar	psi	°C	°F	bar	psi	°C	°F
E01	E03				5	72.5	5	41	E02			
E02	E03				75	999	99.9	150	75	999	99.9	150
E03	0.7	-10.2	-50	-58	0.7	-10.2	-50	-58	E02			
E06	0.0				2.0				50	725	50	50
E08	-0.7	-10.2	-50	-58	0.1	1.5	-30	-22	75	-10.2	99.9	150
F01	F03				19	275.5	45	113	F02			
F02	F03				75	999	99.9	150	75	999	99.9	150
F03	-0.7	-10.2	-50	-58	-0.7	-10.2	-50	-58	F02			
F06	0.0				2.0				50	725	50	50
F10	N.A.		-50	-58	N.A.		28	82.4	N.A.		99.9	150
F11	N.A.		6	42.8	N.A.		12	53.6	N.A.		20	68
P03	60				-60				999			
P04	-60				999				999			
P05	-20	-290	-20	-20	0				20	290	20	20
P06	-60				-60				999			
P07	-60				-60				999			
P08	-20	-290	-20	-20	0				20	290	20	20
P09	N.A.		-20	-20	N.A.		0	0	N.A.		20	20
I11	-20	-290	-20	-20	0				20	290	20	20
S05	-20	-290	-20	-20	0				20	290	20	20
A03	-0.7	-10.2	-50	-58	0	0	-40	-40	75	999	99.9	150
A04	0.1	1.5	0.1	0.1	1	10	1	1	20	290	20	20
A05	0.7	-10.2	-50	-58	20	290	45	113	75	999	99.9	150
A06	0.1	1.5	0.1	0.1	1	10	1	1	20	290	20	20

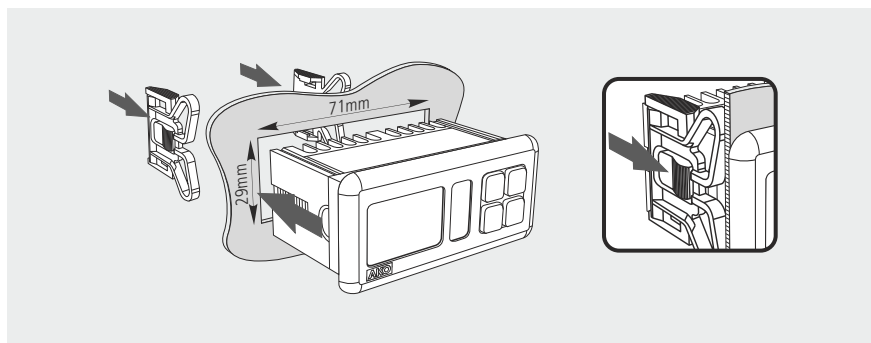
10- Technical specifications

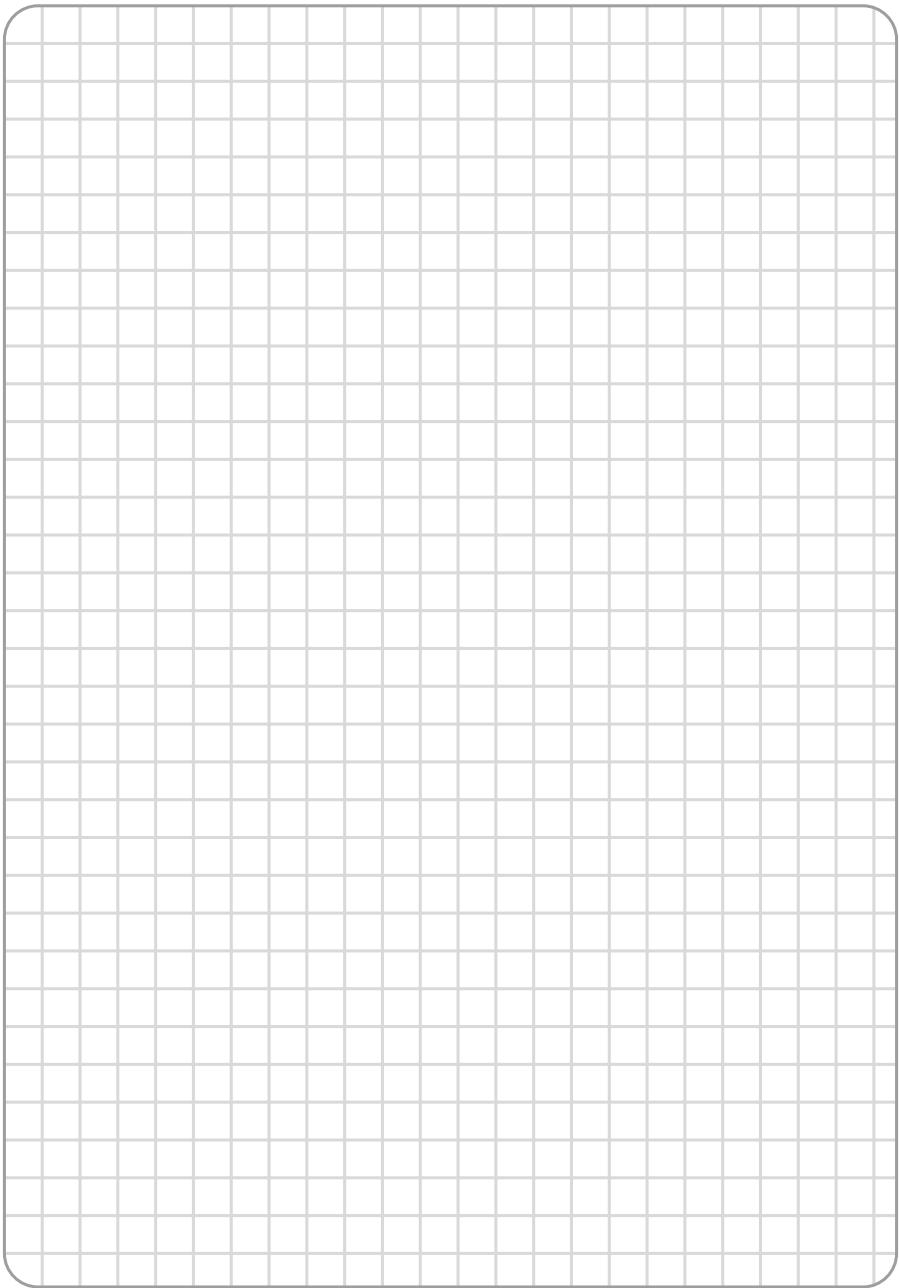
Power supply	90-240 V ~ 50/60 Hz
Maximum voltage in the SELV circuits	20 V
Inputs	2 analog inputs + 6 digital inputs
Relays R1 to R4	(EN60730-1: 5(4) A 250 V ~ SPST)
Relay R5	(EN60730-1: 5(4) A 250 V ~ SPDT)
No. of relay operations	EN60730-1: 100.000 operations
Types of probes	NTC AKO-149xx
	4-20 mA
	0-5 V ratiometric
Measuring range NTC	-50,0 °C to +99,9 °C (-58,0 °F to 211 °F)
4-20 mA / 0-5 V	-60 to 999
Resolution NTC	0.1 °C (0.1 °F)
4-20 mA / 0-5 V	-99.9 to 99.9
	≤ -100 / ≥ 100
Working environment	-10 to 50 °C, moisture <90 %
Storage environment	-30 to 70 °C, moisture <90 %
Protection degree of the front part	IP65
Fixing	Panel mounting with anchors
Panel cavity dimensions	71 x 29 mm
Front part dimensions	79 x 38 mm
Depth	61 mm
Connections:	Terminal to screw for cables with a section of up to 2.5 mm ²
Control device classification: Built-in assembly, with Type 1.B automatic operation action feature, for use in clean situations, logical support (Software) class A and continuous operation. Degree of contamination 2 acc. to UNE-EN 60730-1.	
Double power input insulation, secondary circuit and relay output.	
Rated pulse voltage	2500 V
Pressure ball test temperature: Accessible parts	75 °C
Parts that position active elements	125 °C
Voltage and current declared by the EMC tests:	207 V, 17 mA
Radio interference suppression test current	270 mA

10.1- Dimensions



10.2- Mounting





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