Installation, operating and maintenance

TELECOOL

2µAC ADVANCED CONTROLLER

LENNOX™

• • • **Providing indoor climate comfort**

CONTENTS

GENERAL CHARACTERISTICS

General description

The µAC is an electronic control for the complete management of precision air-conditioners, for "Shelters" with management of the condenser fan.

Main functions:
• Control based on the temperature and humidity of the inlet air
• Energy saving with free-cooling (Shelters) or compensation
• Dehumidification management
• Control of the supply fan speed
• Complete alarm management with log
• Rotation of a series of units
• Time bands
• Can be connected to a serial line for supervisor / telemaintenance

Controlled devices:
• 1 or 2 compressors or valve for cooling battery
• 1 or 2 heating elements or valve for heating battery
• Supply fan in ON-OFF or proportional mode
• Humidifier with proportional or ON-OFF output
• Dehumidification with ON-OFF output
• Alarm device

Options:
• RS485 serial board
• Clock board with memory for logging the alarms and time bands
• Programming key

Programming:
All the machine parameters can be configured not only using the keypad located on the front panel, but also using a hardware key and/or via serial line.

µAC USER INTERFACE

The µAC is made up of a display and a power board, installed together in the same case, see Fig. 1.

The display

The display shows the main measurements monitored and the status of the machine and the actuators. Following is a description of the symbols and the messages shown on the display, and the corresponding meaning. Fig. 2 illustrates all the symbols and the messages shown on the display; this occurs on starting the regulator.
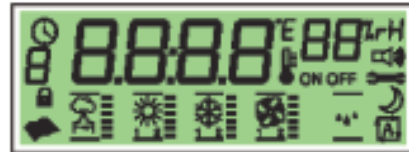

Fig. 1 User interface

Fig. 2 Display

Symbol	Description
8.8.8.8	ambient temperature in prog. displays the value of the parameter
℃ ₀ ℉	temp. unit of measure: degrees Centigrade/Fahrenheit
88	ambient humidity in programming displays the no. of the parameter
%rH	relative humidity unit of measure
◁)))	buzzer active
⌐◦	hour counter limit exceeded
☽	OFF status from time bands
[A]	time bands active
ON OFF	external contact status: - ON - machine enabled; - OFF - machine in stand-by
🌡	indicates that the value displayed is the temperature (with this symbol off the Set-point is displayed)
	time band selected
⋅•⋅	dehumidification active
	ventilation active : % fan speed
	cooling active: - number (1 or 2) cooling actuators; % opening cooling valve, or (in shelter mode) % opening free cooling damper
	heating active: - number (1 or 2) heating actuators - % opening valve
	humidification active: % steam production
◣	programming phase
🔒	- password setting - parameter modification blocked
8	(in clock function) day of the week
◷	clock display - clock set-up

Status indicators

The main states of the regulator (power supply present, alarm active and remote ON/OFF input status) are displayed to the user through 3 LEDs on the front panel.
Meaning of the LED
Line LED (yellow): control powered

Alarm LED (red): machine alarm (the siren symbol on the display is on only when the buzzer is active)
ON LED (green): machine ON from keypad or supervisor (referred to the EEPROM variable). The effective ON status of the machine may, in addition, depend on the ON-OFF digital input, on the active time band, the stand-by condition transmitted from the master unit (if a series of units is in rotation), and is indicated by the illumination of the fan symbol.
The ON-OFF symbols on the Display are illuminated only when the input of the remote contact is enabled and indicate the status of such contact.

The keypad

The buttons have the following meanings:

on/off	- Commutes status: if the machine is on, one press of the button places it in Standby; vice-versa, it is re-enabled.
alarm	- Pressed for 5 secs accesses the User parameters. - In the presence of an alarm silences the buzzer.
▲	- Repeated pressing displays, cyclically: the current time, date and the temperature of the air in the room. - In programming phase scrolls or increases the value of the parameters.
▼	- Held pressed displays the set-point. - In programming phase scrolls or decreases the value of the parameters.
enter	- Pressed for 5 secs accesses the Direct parameters. - In programming phase modifies the value of the selected parameter.
alarm + **enter**	- Pressed together for 5 secs access the Factory parameters.
▲ + ▼	- Pressed together for 2 secs reset the alarms.

INSTALLATION

Initial start-up procedure

To install the control, proceed as indicated below, with reference to the connection diagrams provided.

1. connect the probes and power supply: the probes can be located up to a maximum distance of 50 metres from the control, using cables with a minimum cross-section of 1mm₂; to improve immunity to disturbance it is recommended to use shielded cables (connect one end only of the shield to the ground on the electrical panel).

2. Program the instrument: for a more in-depth description see chapter 5, "Programming".

3. Connect the actuators: it is suggested to connect connectors 1 and 3 only after having programmed the control. On this subject, iavoid to connect loads exceeding the relay rating.

The I/O (Input/Output) board

Fig. 3 shows the I/O board.
With reference to this figure, we can see:
- in the lower part the Molex connectors (1 - 2 - 3), for the main connections;
- in the upper part, the 2nd male connector from the left, to insert the key for programming the µAC or copy the existing data;
- the fitting for the clock board **(optional)**;
- the fitting for the RS485 serial board **(optional)**;
- in the centre of the board, the jumper for selecting the hardware of probe B3 (4÷20mA/ 0÷1Vdc), with default 0÷1Vdc.
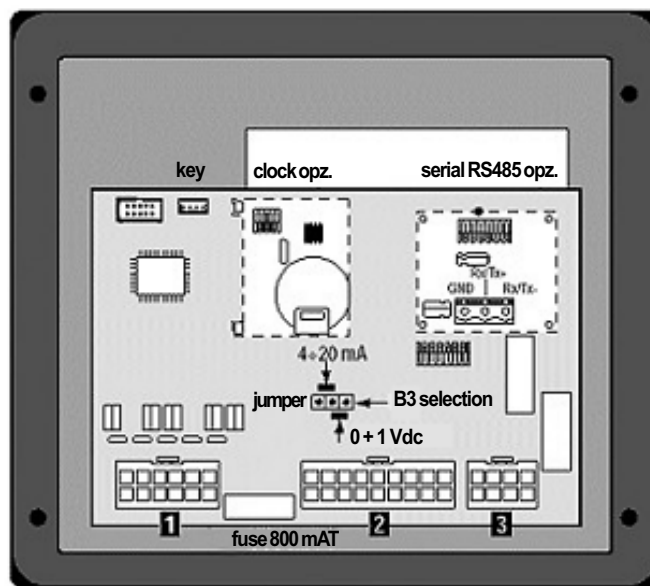

Fig. 3

Meaning of the inputs and the outputs

The following table (P. 6) describes the meaning of the inputs and the outputs according to the type of machine selected. **Telecom=** precision unit complete with condenser and without humidifier.

Inputs and outputs I/O

Digital inputs Connector 2

ID1	Remote ON/OFF (HE=1)
ID2	Flow controller
ID3	Filter dirty
ID4	Heat. Element safety
ID5	External alarm/ input for rotation of a series of units rotation of a series of units (depends on Pb-H2-HA)
ID6	No power alarm
ID7	High press.C1
ID8	Low press. C1
ID9	Comp. thermal
ID10	Fan thermal (H5)

Analogue inputs - Connector 2

B1	Inlet temp. Temp.
B2	External air temp. for free cooling (/1,Hc)
B3	Condens. press. (/2,Hd,Hb)
B4	Supply temp. (/3=1)

SSR digital outputs - Connector 1

Out1	Compressor
Out2	Heating element
Out3	Damper+(/2, Hc) Damper ON/OFF
Out4	Damper - (/2, Hc)
Out5	Supply fan

Relay digital outputs - Connector 3

Out 6	Alarm (HF)
Out 7	Alarm (HA) Rotation control (H2)

Analogue outputs - Connector 1

Y1	Damper output (/2,Hc)
Y2	Condensation fan (/1,/2,Hb,Hc)

OPERATING MODES

Following are descriptions of some examples of the main machine configurations.

Precision units for telecom
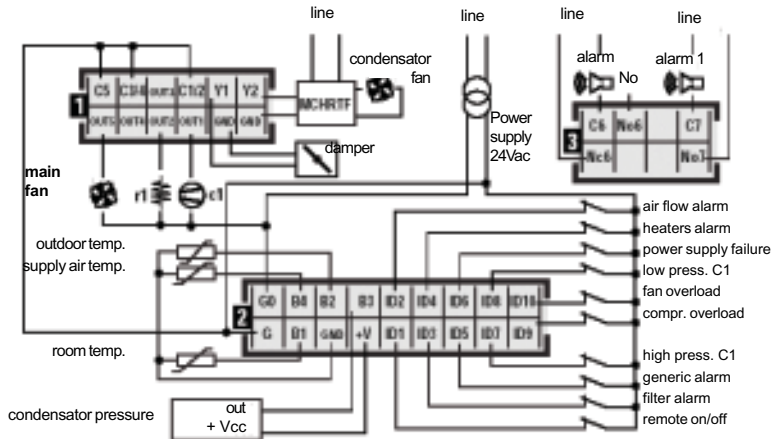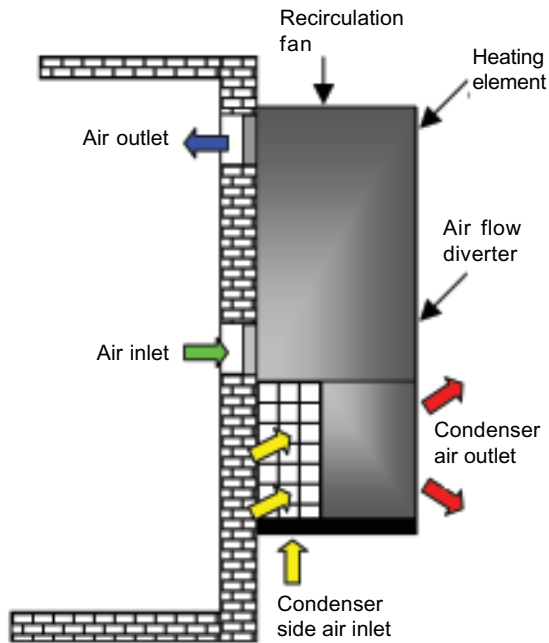
Connecting a series of units

This configuration is possible both for direct expansion (ED) and battery (CW) machines, as well as Shelter models. This allows the timed rotation of a unit in stand-by within a group of maximum 2 units. If one of the machines in operation goes into an alarm condition, theunit in stand-by is activated.

This is done using a digital input and output which, via the "master" (unit 1), sends the command to activate and deactivate the unit in stand-by (the command is updated every 10 minutes).
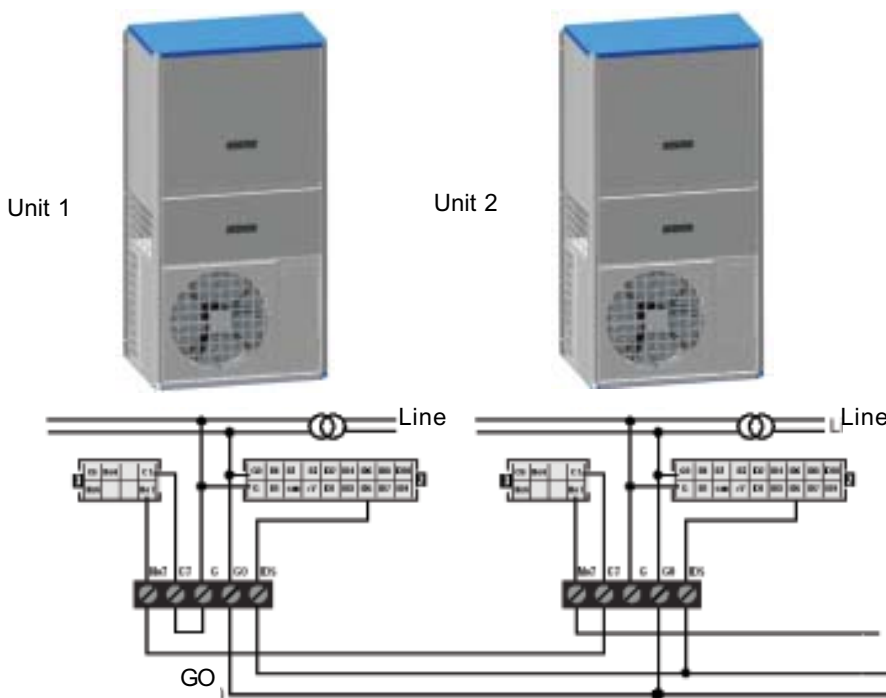
Fig. 3 Connecting 2 units

The diagram shows how all the electrical panels can be the same, and only during installation does connection have to be made, as in Fig. 4, using a three-pole cable between one precision unit and the next. During installation the following three points must be kept in mind:

1. one (and only one) machine must be set as master;
2. it is recommended to terminate the line with a resistor (Rt), value 220 . 5W or 470 . 4W.
3. check that G0 on the transformers is not earthed, to avoid unwanted current at G0.
For operation, parameters H2, H3, H4, HA must be set (see following parameter table and description).

PROGRAMMING PARAMETERS AND THEIR MODIFICATION

Parameters

The parameters are divided into 3 levels, each of which contains the previous, which the user can access to customise the operation of the µAC.
N.B. It is not possible to move directly from one level to another; the current programming phase must be terminated before accessing the desired level (see parameter HL).

Level Access
DIRECT (D): immediate access
USER (U): access via password 22 (parameter HH)
FACTORY (F): access via factory password 177

Parameter modification

Accessing Direct parameters (D)
The value of the first accessible parameter is displayed in the upper right, with the parameter code flashing.

5 Sec.
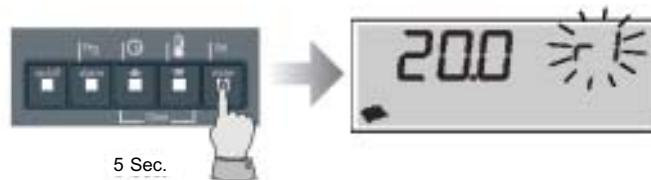
Accessing User parameters (U)
The number 0 is displayed and, on the left the lock symbol 🔒, confirming access via password to the procedure.
- The 🔼 and 🔽 buttons are used to enter the password **22** (default), which is confirmed by pressing the 🔲 button. The value of the first accessible parameter is then displayed in the upper right, with the parameter code flashing.

5 Sec.

Accessing Factory parameters (F)

The number 0 is displayed and, on the left the lock symbol 🔒, confirming access via password to the procedure.

- The ⬆ and ⬇ buttons are used to enter the password **177**, which is confirmed by pressing the ⊡ button.
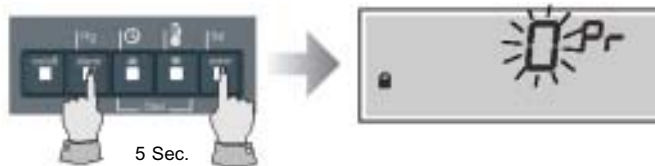
5 Sec.

The value of the first accessible parameter is then displayed in the upper right, with the parameter code flashing. The ⬆ and ⬇ buttons can be used to scroll the various parameters.

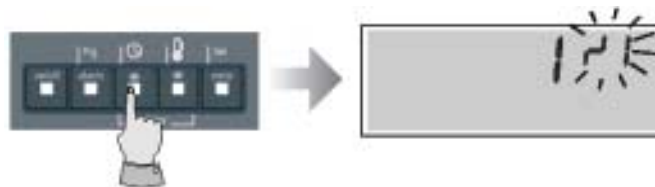Once having entered any level of parameters, one pressing of the button displays the value, flashing, of the parameter selected, while the ⬆ and ⬇ buttons can be used to modify such value.
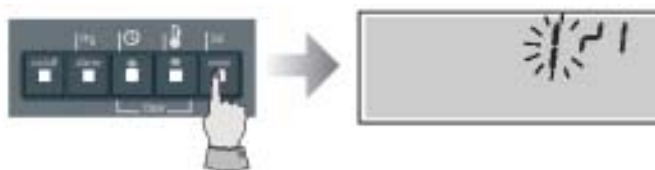
Press ⊡ again to temporarily store the new value. Then, using the ⬆ and ⬇ buttons, scroll the parameters menu, repeating the previous steps for each parameter to be modified. Press the ⊡ button, on the other hand, to store the modifications made and exit programming. During all phases of setting the parameters the open book symbol 📖 is displayed in the lower left of the display; on the other hand, when setting the password, a lock 🔒 also appears, confirming the presence of a "block". The presence of the parameters in the various families depends on the value of some of these:

1. presence of external air probe;
2. presence of humidity probe;
3. presence of supply air probe.

Setting the default parameters
Pressing the button 🔳 on start up saves the default parameters in the EEPROM. During this operation the message **dF** is displayed.

Copying data from the key to the machine's EEPROM
With the power disconnected from the µAC, insert the key in the relative connector.

Powering the machine while keeping the 🔳 button pressed programs the machine's parameters with the values of the data contained in the programming key. During this operation the message **CE** is displayed, and, in the case of errors, **CEEE**.

Copying data from the machine's EEPROM to the key
Pressing the 🔳 and 🔳 button together on start up allows the key to be programmed with the machine's parameters. During this operation the message **EC** is displayed, and, in the case of errors, **ECEE**.

Adjusting LCD contrast
The contrast of the display can be adjusted to suit the effective angle of viewing. Pressing the 🔳 and 🔳 button at the same time increases the value, vice-versa, 🔳 and 🔳 decreases it.

Important warning
After having modified any parameters which alter the machine's configuration (number of compressors, presence of valve, etc.), the alarm delays or compressor times may vary as a consequence; in order to have correct operation immediately, it is recommended to reset the regulator by disconnecting the power supply. In addition, such selections must be made with the actuators disconnected, so as to avoid unwanted activation of the latter.

DESCRIPTION AND CONFIGURATION OF THE PARAMETERS

/	Probes	Type HL= 0	1	2	3	Min	Max	U.o. M.	Var.	Def.	Pres.
1	Presence external air probe B2 0= absent 1= NTC Carel	F	F	U	U	0	1	flag	1	0	
2	Type of humidity press./temp. probe B3 0= absent 1= 0-1Vdc or 0-20mA 2= 4-20mA	F	F	F	F	0	2	flags	1	0	
3	Presence supply air B4 0= absent 1= NTC Carel (enable corresp. alarm)	F	F	F	F	0	1	flag	1	0	
4	Value of pressure at 0mA, 4mA or 0Vdc	F	F	F	F	0	/5	%rH bar	0.1	0	/2≠0
5	Value of humidity/pressure at 20mA or 1Vdc	F	F	F	F	/4	100	%rH bar	0.1	100	/2÷0
6	Calibration probe B1	U	F	U	U	-6.0 -10.8	6.0 10.8	°C °F	0.1	0.0	
7	Calibration probe B2	U	F	U	U	-6.0 -10.8	6.0 10.8	°C °F	0.1	0.0	/1÷0
8	Calibration probe B3	U	F	U	U	-10.0 10.0	%rH/ bar	0.1	0.0	/2.0	
9	Calibration probe B4	U	F	U	U	-6.0 -10.8	6.0 10.8	°C °F	0.1	0.0	/3÷0
A	Digital filter	U	F	U	U	1	15	-	1	4	
b	Input limit	U	F	U	U	1	15	-	1	8	
c	Unit of measure (0=°C,1=°F)	U	U	U	U	0	1	flag	1	0	

R	Regulation	Type HL= 0	1	2	3	Min	Max	U.o.M.	Var.	Def.	Pres.
1	Temperature Set Point (cooling)	D	D	D	D	rA	rb	°C/°F	0. 1	20.0	
2	Cooling differential	D	D	D	D	0.1 0.1	11.0 19.8	°C °F	0.1	3.0	
3	Heating differential	D	D	D	D	0.1 0.1	11.0 19.8	°C °F	0.1	2.0	
4	Temperature dead zone	D	D	D	D	0.1 0.1	11.0 19.8	°C °F	0.1	1.0	
5	Humidity Set Point	D	D	D	D	rc	rd	%rH	1	50	/2≠0
6	Humidification differential	D	D	D	D	1	20	%rH	1	4	/2≠0
7	Dehumidification differential	D	D	D	D	1	20	%rH	1	3	/2≠0
8	Humidity dead zone	D	D	D	D	0	20	%rH	1	2	/2≠0
9	Temperature Set Point (heating)	D	D	D	D	rA	rb	°C/°F	0.1	18.0	
A	Minimum temperature set point (also for compensation)	U	F	U	U	-20 -4	rb	°C °F	0.1	0	
B	Maximum temperature setpoint (also for compensation)	U	F	U	U	rA	60 140	°C °F	0.1	50	
C	Minimum humidity set point	U	F	U	U	0	rd	%rH	1	0	/2≠0
D	Maximum humidity set point	U	F	U	U	rc	100	%rH	1	100	/2≠0
E	Type of temperature regulation 0= P, 1= P+I	U	F	U	U	0	1	flag	1	0	
F	Integration time for PI action	U	F	U	U	10	3600	s	1	600	rE≠0
G	Authority (unique for Cooling/heating) for compensation	U	F	U	U	-2.0	2.0		0.1	0.5	/1≠0
H	Set Point compensation on temp. read by B2 (cooling)	U	F	U	U	-20-4	60 140	°C °F	0.1	25.0	/1≠0
I	Set Point compensation on temp. read by B2 (heating)	U	F	U	U	-20-4	60 140	°C °F	0.1	10.0	/1≠0
L	Free cooling differential	U	F	U	U	0 0	30 54	°C °F	1	9	/1≠0
N	Supply temperature lower limit	U	F	U	U	-20 -4	30 86	°C °F	1	5	/1≠0
O	Reading from probe B2	D	D	D	D			°C/°F			/1≠0
P	Reading from probe B3	D	D	D	D			%rH/bar			/2≠0
R	Reading from probe B4	D	D	D	D			°C/°F			/3≠0
T	Time band setting 0= disabled 1= fan on min. with temp.monitoring 2= ON/OFF	U	U	D	D	0	2	flags	1	0	

c	Compressor	Type				Min	Max	U.o. M.	Var.	Def.	Pres.
	HL=	0	1	2	3						
1	Minimum ON time	U	F	F	F	0	300	s	1	60	
2	Minimum OFF time	U	F	F	F	0	900	s	1	60	
3	Time between 2 start-ups	U	F	F	F	0	900	s	1	360	
4	ON delay between the 2 compressors	U	F	F	F	0	300	s	1	30	
5	OFF delay between the 2 compressors	U	F	F	F	0	300	s	1	0	
6	Compressor rotation 0= disabled 1= enabled										
7	Delay comp. ON from supply fan start-up	F	F	F	F	0	1	flag	1	0	
8	Hour counter threshold for the compressor	U	F	U	F	0	300	s	1	20	
	0= disabled	U	U	U	U	0	30000	h	1	0	
9	Hour counter compressor 1	D	U	D	U	0	30000	h	-	0	
A	Hour counter compressor 2	D	U	D	U	0	30000	h	-	0	

F	Fans	Type				Min	Max	U.o. M.	Var.	Def.	Pres.
	HL=	0	1	2	3						
1	Fan operating mode 0= always ON 1= proportional speed regulation. If used in condensation the fan is kept at minimum even below the value of F5 2= proportional speed regulation. If used in condensation the fan is switched off below the value of F5, with an hysteresis of 0.5 bar for pressure or 1°C for temperature	F	F	F	F	0	2	flags	1	1	F
2	Minimum Triac voltage threshold	F	F	F	F	0	F4	step	1	35	
3	Maximum Triac voltage threshold	F	F	F	F	F3	100	step	1	75	
4	Triac pulse width	F	F	F	F	0	15	m s	1	2	
5	% regulation band for minimum speed or temperature/pressure for minimum speed in condensation	U	F	U	F	0 0 /4	F6	% °C°F bar	0.1	20	
6	% regulation band for maximum speed or temperature/pressure for maximum speed in condensation	U	F	U	F	F5	100 158 /5	% °C°F bar	0.1	100	
7	Minimum output value	U	F	U	F	0	F8	%	1	10	
8	Maximum output value	U	F	U	F	F7	100	%	1	100	
9	Fan hour counter threshold 0= disabled	U	U	U	U	0	30000	h	1	0	
A	Supply fan hour counter	D	U	D	U	0	30000	h	-	0	
B	Filter hour counter threshold 0= disabled	U	U	U	U	0	30000	h	1	0	
C	Filter hour counter	D	U	D	U	0	30000	h	-	0	
D	Supply fan OFF delay	U	F	U	F	0	900	s	1	20	
E	Fan pick-up time in condensation	U	F	F	F	0	60	s	1	4	

P	Alarm	Type HL= 0	1	2	3	Min	Max	U.o.M.	Var.	Def.	Pres.
1	Flow alarm delay from fan start-up	U	F	F	F	0	250	s	10	20	
2	Flow alarm delay during operation	U	F	F	F	0	90	s	1	5	
3	Low pressure alarm delay from compressor ON	U	F	F	F	0	250	s	1	40	
4	Buzzer activation 0= OFF, 1-14= min. 15= continuous	U	U	U	U	0	15	min	1	0	
5	Reset alarms (various configurations)	F	F	F	1	5	flag	1	1	5	
6	Delta from effective set point for low temperature alarm	U	F	U	U	0	50 90	°C °F	1	10	
7	Delta from effective set point for high temperature alarm	U	F	U	U	0	50 90	°C °F	1	10	
8	Delta from set point for low humidity alarm	U	F	U	U	0	50	%rH	1	20	/2≠0
9	Delta from set point for high humidity alarm	U	F	U	U	0	50	%rH	1	20	/2≠0
A	Alarm delay high/low temperature/humidity on start-up	U	U	U	U	0	150	min	1	20	
b	Type of management of generic alarm input ID5 0= no alarm connected 1= signal only alarm - automatic reset 2= signal only alarm - manual reset 3= serious alarm - automatic reset 4= serious alarm - manual reset 5= serious alarm - automatic reset also active in stand-by 6= serious alarm - manual reset also active in stand-by	U	F	U	F	0	6	flag	1	1	
c	Generic alarm delay	U	U	U	F	0	250	s	1	60	Pb≠0
d	Return-supply temp. difference for supply temp. alarm	U	F	F	F	0	20 36	°C °F	0.1	3	/3≠0
E	Input ID4 selection	U	F	U	F	0	1	flag	1	0	
F	Input ID9 selection	U	F	F	F	0	1	flag	1	0	
G	High temper. prealarm enabling	U	F	U	U	0	1	flag	1	0	

H	General	Type HL= 0	1	2	3	Min	Max	U.o.M.	Var.	Def.	Pres.
1	Machine model 0= ED unit 1= CW unit 2= CW unit (H/C) 3= shelter	F	F	F	F	0	3	flags	1	0	
2	No. of machines in rotation 0= stand-alone machine 1= unit (master) 2= units........6= 6 units	U	U	U	U	0	6	flags	1	0	
3	Address of unit in rotation	U	U	U	U	1	6	-	1	1	H2≠0
4	Rotation time between a series of units 0= test mode t=2 min	U	U	U	U	0	250	h	1	0	H2≠0
5	Operating mode of the 2 "cool" outputs Out1/Out2 1= 1 compressor 2= compressors on 2 circuits 3= three-point valve 4= 2 compressors in binary parallel 5= 2 compr.s in tandem (50+50%)	F	F	F	F	1	5	flags	1	1	
6	Operating mode of the 2 "heat" outputs Out3/Out4 0= no heating element 1= 1 heating element 2= 2 heating elements 3= three-point valve 4= 2 heating elements in binary	F	F	F	F	0	4	flags	1	1	

H	General	Type				Min	Max	U.o.M.	Var.	Def.	Pres.
	HL=	0	1	2	3						
7	3P valve or damper excursion time	F	F	F	F	0	600	s	1	150	
8	Presence of humidifier	F	F	F	F	0	1	flag	1	0	
9	Type of dehumidification 0= comp. 1 ON 1= comp. 2 ON 2= two comp. ON 3= capacity-controlled cooling ramp 4= fan speed reduction 5= action 4+0 6= action 4+1 7= action 4+2 8= action 4+3 9= no action	F	F	F	F	0	9	flags	1	0	
A	Function of the dehumidification / humidification relay 0= energised in dehumidification 1= de-energised in dehumidification 2= relay for non-serious alarms (follows logic of parameter HF) 3= output for rotation control 4= energised in humidification 5= de-energised in humidification 6= 2 fan selection on during deum. 7= 2 fan selection off during deum.	F	F	F	F	0	7	flags	1	0	
B	Function of output Y2 (phase-cut) 0= supply fan speed control 1= condensation fan speed control using B3 2= condensation fan speed control using B2	F	F	F	F	0	2	flags	1	0	
C	Function of probe B2 0= compensation 1= free-cooling using 0-10V 2= free-cooling using Out3-Out4 3= free-cooling ON/OFF with Out3 4= condensation control	F	F	F	F	0	3	flag	1	0	
d	Function of probe B3 0= humidity control 1= condensation control	F	F	F	F	0	1	flag	1	0	/2≠0
E	ON/OFF digital input 0= absent 1= present	U	U	U	U	0	1	flag	1	0	
F	Alarm relay logic 0= de-energised in alarm for all alarms 1= energised in alarm for all alarms 2= de-energised in alarm only for serious alarms 3= energised in alarm only for serious	U	U	U	F	0	3	flags	1	0	
G	alarms	U	U	U	U	0	300	s	1	0	
H	Delay on start-up	U	U	U	U	0	200	-	1	22	
I	USER password	U	U	U	U	0	1	flag	1	0	
L	Block parameter modifications (displayed by lock) 0= no block	F	F	F	F	0	3	flags	1	0	
n	Parameter sets	U	F	U	F	0	2	flags	1	0	
o	Select data shown on display 0= probes B1, B3 (if present) 1= temperature. and humid. set-point (if present) 2= day and time (if clock present)	U	U	U	U	1	200	-	1	1	
P	Supervisor network serial address	U	U	U	U	1	5	flags	1	5	
	Supervisor serial baudrate 1= 1200, 2= 2400, 3= 4800, 4= 9600, 5=19200 Baud										

= probe parameters

1 Presence external air probe B2.
Sets the presence of probe NTC B2, the corresponding function must be selected using parameter HC.
0= probe absent
1= NTC Carel probe
Range: 0÷1 flag Def.: 0

2 Type of probe B3
Sets the type of probe B3 (0-20mA, 4-20mA, 0-1V).
N.B. This setting must also be accompanied by the setting of the jumper (B3 selection - see Fig. 3).
The corresponding function must be selected using parameter Hd.
0= probe absent
1= 0÷1V or 0÷20mA
2= 4÷20mA
Range: 0÷2 flags Def.: 0

3 Presence supply air probe B4
Sets the presence of NTC probe B4.
0= probe absent
1= NTC Carel probe (also enables the corresp. alarm in cooling function, see parameter Pd.)
Range: 0÷1 flag Def.: 0

4 Minimum value measured by input B3 at 0mA, 4mA or 0Vdc
This parameter allows the configuring of the minimum value for probe B3.
Range: 0÷/5%rH, bar Def.: 0

5 Maximum value measured by input B3 at 20mA or 1Vdc
This parameter allows the configuring of the max. value for probe B3.
Range: /4÷100%rH, bar Def.: 100

6 Calibration input B1
Corrects the value measured by B1.
Range: -6.0 ÷ 6.0°C -10.8 ÷ 10.8°F Def.: 0.0

7 Calibration input B2
Corrects the value measured by B2.
Range: -6.0 ÷ 6.0°C -10.8 ÷ 10.8°F Def.: 0.0

8 Calibration input B3
Corrects the value measured by B3.
Range: -10.0 ÷ 10.0%rH, bar Def.: 0.0

9 Calibration input B4
Corrects the value measured by B4.
Range: -6.0 ÷ 6.0°C -10.8 ÷ 10.8°F Def.: 0.0

A Digital filter
Stabilises the coefficient used in the digital filtering of the measured value. High values for this parameter allow the elimination of any transitory disturbance at the analogue inputs (yet diminish the speed of measurement). The suggested value is 4.
Range: 1÷15 Def.: 4

b Input limit
Stabilises the maximum variation which can be measured by the probes in a machine program cycle; in practice, the maximum variations allowed in the measurements are between 0.1 and 1.5 units (bar, °C or °F depending on the probe and the unit of measure) per second approximately. Low values for this parameter allow the effect of impulsive-type disturbance to be limited. Suggested value 8.
Range: 1÷15 Def.: 8

C Unit of measure
Sets the unit of measure for the temperature displayed. On changing this parameter the µAC **automatically** performs the conversion of all the configuration parameters (set point, differentials, maximum limits etc.), except for F5 and F6.
The display always indicates the unit in use.
0= degrees Centigrade (°C) used.
1= degrees Fahrenheit (°F) used.
Range: 0÷1 flag Def.: 0

Note: if the variation from Centigrade to Fahrenheit, and vice-versa, is performed by the supervisor, the parameters are not converted (only the value read by the temperature probes and the symbol on the display change).

r = regulation parameters

r1 Temperature set point (cooling)
Sets the temperature set point (diag. at the end of the paragraph). If the model configured using parameter H1 is CW cool/heat, this set point represents the cooling set point (see parameter r9). This is activated by the digital input ID7.
Range: rA÷rb °C, °F Def.: 20.0

r2 Cooling differential
Sets the differential for cooling (see diagrams at the end of the paragraph).
Range: 0.1 ÷11.0°C 0.1÷ 19.8°F Def.: 3.0

r3 Heating differential
Sets the differential for heating (see diagrams at the end of the paragraph).
Range: 0.1÷11.0°C 0.1÷ 19.8°F Def.: 2.0

r4 Temperature dead zone
Sets the dead zone (see diagrams at the end of the paragraph). When the temperature measured by probe B1 is within the dead zone, all actuators are off, except for in the following cases:
• the minimum ON time or the OFF delay between the two compressors has not yet elapsed (C1,C5);
• the compressors (or the valve) are operating following a request for dehumidification.
Range: 0.1÷20.0°C 0.1÷36.0°F Def.: 1.0

r5 Humidity set point
Sets the humidity set point (see diagrams at the end of the paragraph).
Range: rc÷rd%rH Def.: 50

r6 Humidification differential
Sets the humidific. differ. (see diagrams at the end of the paragraph).
Range: 1÷20%rH Def.: 4

r7 Dehumidification differential
Sets the dehumidific. differ. (see diag. at the end of the paragraph).
Range: 1÷20 rH Def.: 3

r8 Humidity control dead zone
Sets the dead zone (see diagrams at the end of the paragraph). When the humidity measured by probe B3 is within this zone, the 0-10V output, which activates the humidifier, is at 0 and dehumidification is not active.
Range: 1÷20%rH Def.: 2

r9 Temperature set point (heating)
Heating set point for the model CW cool/heat (H1= 2). This is activated by the digital input ID7.
Range: rA÷rb°C, °F Def.: 18.0

rA Minimum temperature set point
Limits the minimum value of parameters r1 and r9.With compensation of the set point, using the external air probe, this value also represents the lower limit for the excursion of the set point.
Range: -20÷rb°C 4÷rb°F Def: 0

rb Maximum temperature set point
Limits the maximum value of parameters r1 and r9.With compensation of the set point, using the external air probe, this value also represents the upper limit for the excursion of the set point.
Range: rA÷60°C rA÷140°F Def: 50

rc Minimum humidity set point
Limits the minimum value which can be set using parameter r5.
Range: 0÷rd%rH Def.: 0

rd Maximum humidity set point
Limits the maximum value which can be set using parameter r5.
Range: rc÷100%rH Def.: 100

rE Type of temperature regulation
Selects the type of regulation.
0= proportional-type regulation
1= proportional + integral-type regulation.
Range: 0÷1 flag Def.: 0

rF Integration time for P+I action
Time constant for P+I regulation. Once the set time has elapsed, if the error is still constant, the effect of the integral action is equal as that for proportional. P+I regulation guarantees maximum effectiveness when starting from stable proportional regulation. P+I regulation is active only if the value read by the probe is within 110% of the proportional zone. The integrator is reset in stand-by, in sleep mode and in dehumidification.
Range: 10÷3600s Def.: 600

rG Authority for compensation
Constant for compensation of the operating set point based on the temperature measured by probe B2.
Range: -2.0÷2.0 Def.: 0.5

rH Cooling set point compensation
Establishes the set point (for external temperature B2) beyond which compensation begins.
Range: -20÷60°C -4÷140°F Def.: 25.0

ri Heating set point compensation
Establishes the set point (for external temperature B2) below which compensation begins.
Range: -20÷60°C -4÷140°F Def.: 10.0

rL Free cooling differential
Sets the differential to trigger the activation of free cooling (shelters), that is external air inlet by the opening of a damper. The free-cooling action is dependent on the following relationship:
B1-B2 > rL i.e. (room temperature - external air temperature) > rL

The trigger is excluded with a fixed relative differential of 1.5°C (P. 22). The trigger is also excluded if probe B2 is malfunctioning. The percentage of opening of the damper is shown on the display via the vertical bars next to the ice symbol, while the start-up of the compressor is indicated by the number 1 below the symbol itself. If free-cooling is activated in ON-OFF (Out3), the bars may be either all on or all off depending on the status of the damper.
Range: 0÷30°C 0÷54°F Def.: 9

rn Lower supply temperature limit
This parameter represents the minimum limit for the supply temperature below which the damper of the shelter is closed. With probe B4 present, the regulation is of the type described in Fig. 6. The percentage of opening of the damper, see Fig. 6, is reduced proportionally until it is completely closed if the supply temperature is lower than **rn-3°C**. This prevents air of a too low temperature being sent into the room. In the ED and CW configurations, the actuators turn OFF progressively, when the supply temperature falls below the m set, the differential is fixed at 3°C. During dehumidification, no limitation of the supply temperature is made.
Range: -20÷30°C -4÷86°F Def.: 5

ro Reading probe B2
External air temperature. **Only appears when the probe is installed.**

rP Reading probe B3
Percentage of humidity or pressure value. **Only when the probe is installed.**

rr Reading probe B4
Supply air temperature. **Only appears when the probe is installed.**

rt Time band setting
Sets, if the clock option is installed, the time band mode (see chap. 7)
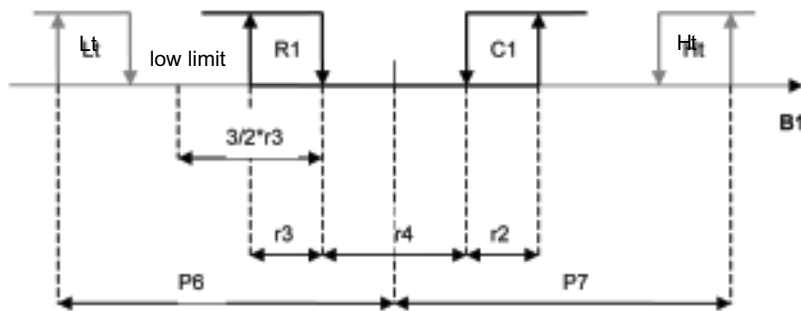**0=** time bands disabled
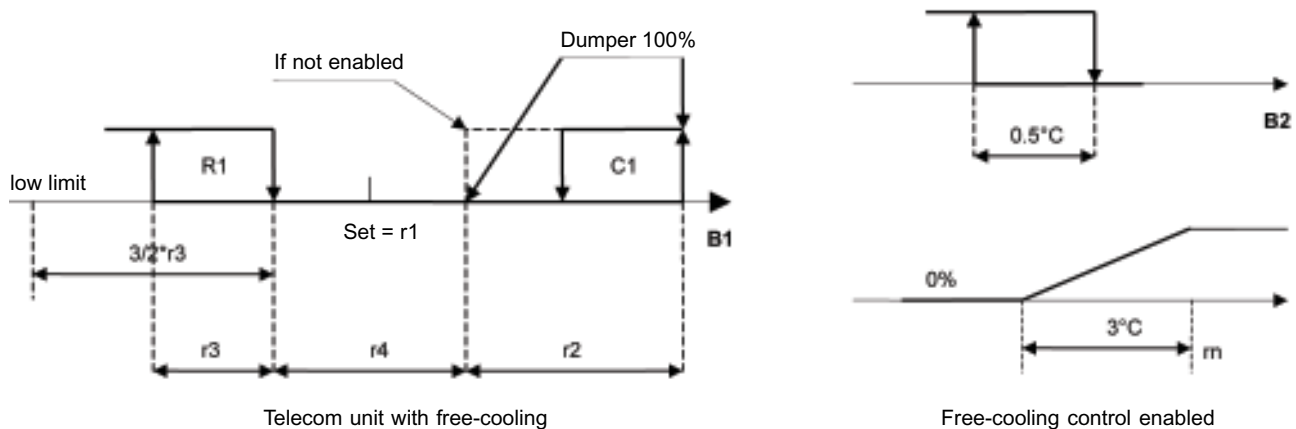**1=** fan on at minimum speed with temperature monitoring
2= ON/OFF
Range: 0÷2 flags Def.: 0

Temperature regulation diagrams

Fig. 3 : 1heating element and 1 compressor

Diagrams showing operation with free-cooling

Telecom unit with free-cooling

Free-cooling control enabled

Fig. 3 : Diagram showing operation with free-cooling

c= compressor management parameters

c1 Minimum ON time
Sets the minimum activation time for the compressor, irrespective of request (see diagram at the end of the paragraph).
Range: 0÷300s Def.: 60

c2 Minimum OFF time
Sets the minimum off time for the compressor, irrespective of request (see diagram at the end of the paragraph).
Range: 0÷900s Def.: 60

c3 Minimum time between two start-ups
Sets the minimum time between two successive start-ups of the same compressor, irrespective of request. This limits the number of start-ups by time (see diagram at the end of the paragraph).
Range: 0÷900s Def.: 360

c4 Minimum time between the start-up of two compressors
Sets the minimum time which must elapse between successive start-ups of 2 compressors (if configured for 2 comp.). Delaying the activation of the compressors avoids overloading the line due to close or simultaneous peaks.
Range: 0÷300s Def.: 30

c5 OFF delay between the two compressors
Sets the minimum time which must elapse between the shutting down of different compressors.
Range: 0÷300s Def.: 0

c6 Compressor rotation
Allows the compressors to exchange priority for start-up and shut-down.
0= rotation disabled
1= rotation enabled (with H5= 2 or 5).
The rotation is FIFO, that is the fist compressor to be switched on is the first to be switched off.
Range: 0÷1 flag Def.: 0

c7 Comp. ON delay from supply fan start-up
Sets the minimum time which must elapse between the start-up of the fan and the activation of the compressor.
Range: 0÷300s Def.: 20

c8 Hour counter threshold for compressor operation
Sets the number of hours of compressor operation beyond which the maintenance request is signalled.
0= this function is not handled.
Range: 0÷30000 hours Def.: 0

c9 Hour counter compressor 1
cA Hour counter compressor 2
Indicates the number of operating hours of compressor 1 and/or 2. Pressing the 🔘 and 🔘 buttons together during the display of this parameter resets the hour counter (only in USER or FACTORY mode) and cancels the maintenance request, if enabled. Management of the hour counter is suspended during the setting of the parameters, while the data is written to the EEPROM every 30 mins.
Range: 0÷30000 hours Def.: 0

F= fan management parameters

F1 Fan operating mode
This parameter imust be set to 0 during the setting of limits F2 and F3.
0= always ON
1= proportional speed regulation with minimum speed
2= proportional speed regulation with cut-off
The values 1 or 2 indicate operation of the supply fan in proportional mode with Hb=0; if, on the other hand, phase-cut is used for the condensation fan with Hb= 1 or 2, operation is that described in the diagrams at the end of the paragraph. The fan is only activated when at least one of the compressors is on. In the case of condensation probe B3 malfunction, the fan is forced on at maximum speed, (F8), if the external temperature (B2) is greater than 15°C; on the other hand, if the temperature is lower than 15°C, the fan operates at an average of the values F7 and F8.
Range: 0÷2 flags Def.: 1

F2 Minimum triac voltage threshold
F3 Maximum triac voltage threshold
In the case of proportional fan speed regulation, installation of the power board MCHRTF*0A0 is required. In this case parameters F2 and F3 must be set to obtain at the output the minimum and maximum voltage, respectively, accepted by the motor used. The values set do not correspond to the effective voltage in Volts, but to an internal calculation of the μAC. With the CONV0/10A0 module, or with FCS3** three-phase regulators, set F2= 0 and F3= 100.
Range F2: 0÷F4 step Def. F2: 35
Range F3: F3÷100 step Def. F3: 75

F4 Duration of triac impulse
Represents the width, in milliseconds, of the on pulse of the triac. For inductive-type motors set F4= 2; on the other hand, for capacitative-type motors or with the CONV0/10A0 module, or with FCS3** three-phase regulators, set F4= 0.
Range: 0÷15ms Def.: 2

F5 Regulation band percentage for minimum speed or temp./pressure for minimum speed in condensation
F6 Regulation band percentage for maximum speed or temp./pressure for maximum speed in condensation
When fan speed regulation is used to control the main fan, F5 and F6 represent the percentage of the regulation band; when on the other hand it is used to control the condensation fan, F5 and F6 are absolute temperature or pressure values (see Fig. 7).
Warning: if the parameter indicates a temperature, this is not automatically converted to Fahrenheit on changing the parameter /C (see diagrams at the end of the paragraph).
Range F5: 0÷F6%, °C, °F F5: /4÷F6 bar Def. F5: 20
Range F6: F5÷100% F5÷158°C, °F F5÷/5 bar Def. F6: 100

F7 Minimum output value
Specifies a speed value above the minimum value, set using the parameter F2. (see diagrams at the end of the paragraph).
Range: 0÷F8% Def.: 10

F8 Maximum output value
Specifies a speed value below the maximum value, set using the parameter F3. (see diagrams at the end of the paragraph).
Range: F7÷100% Def.: 100

F9 Supply fan hour counter threshold
Sets the number of fan operating hours beyond which the maintenance request is signalled.
0= this function is not handled.
Range: 0÷30000 hours Def.: 0

FA Supply fan hour counter
Indicates the number of operating hours of the fan. Pressing the and buttons together during the display of this parameter resets the hour counter (only in USER or FACTORY mode) and cancels the maintenance request, if enabled.
Range: 0÷30000 hours Def.: 0

Fb Filter hour counter threshold
Sets the number of filter operating hours beyond which the maintenance request is signalled.
0= this function is not handled.
Range: 0÷30000 hours Def.: 0

FC Filter hour counter
Indicates the number of operating hours of the filter. This hour counter is increased if the fan is working; as a result, until reset the first time has the same value as FA. Pressing the and buttons together during the display of this parameter resets the hour counter (only in USER or FACTORY mode) and cancels the maintenance request, if enabled.
**Range: 0÷30000 hours Def.: 0**

Fd Supply fan off delay
Specifies the time, in seconds, during which the fan stays on, after switching from ON => STAND-BY (keypad, time bands, digital input, rotation).
Range: 0÷900s Def.: 20

FE Fan pick-up time in condensation
Sets the operating time at maximum speed on starting-up the fans, if used for condensation control, to overcome the mechanical inertia of the motor. If set to 0 the function is not performed, that is the fans are activated at minimum speed and then controlled according to the condensation temperature/pressure.
Range: 0÷60s Def.: 4

Operating diagrams of the condensation fan in telecom
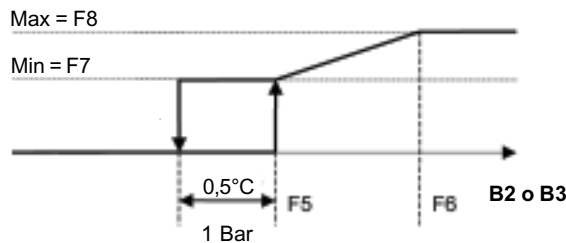
Fig. 3 : Condensation fan control

P= alarm management parameters

P1 Flow alarm delay from fan start-up
Sets a delay in recognising the air flow alarm (FL) on fan start-up, delaying as well the activation of the other actuators to allow the reading of a possible flow alarm.
Range: 0÷250s Def.: 20

P2 Flow alarm delay during operation
Sets a delay in recognising the air flow alarm (FL) during the operation of the fan.
Range: 0÷90s Def.: 5

P3 Low pressure alarm delay from compressor start-up
Sets a delay in recognising the low pressure alarm on the start-up of the compressor/s, to allow the operating conditions to be reached.
Range: 0÷250s Def.: 40

P4 Buzzer activation
Sets the activation time for the buzzer in the case of alarms:
0= buzzer always disabled.
1÷14= buzzer is silenced automatically after P4 minutes
15= buzzer stays on until the alarm condition no longer exists (automatic reset) or until the Alarm button is pressed. If after silencing the buzzer, manually or automatically after a set time, a new alarm occurs, the buzzer is reactivated.
Range: 0÷15 mins Def.: 0

P5 Reset alarms
Allows the selection of various reset configurations (manual or automatic) for the alarms.
Range: 1÷5 flag Def.: 1

Cod.	Description	P5= 1	P5= 2	P5= 3	P5= 4	P5= 5
E1	probe B1	auto	auto	man	auto	auto
E2	probe B2	auto	auto	man	auto	auto
E3	probe B3	auto	auto	man	auto	auto
E4	probe B4	auto	auto	man	auto	auto
EE	EEPROM run	man	man	man	man	man
EL	insuff. power on EEPROM write	man	man	man	man	man
H1	high pressure C1	man	man	man	man	man
H2	high pressure C2	man	man	man	man	man
L1	low pressure C1	man	auto	man	auto	auto
L2	low pressure C2	man	auto	man	auto	auto
F1	filter dirty	man	auto	man	man	auto
FL	flow	man	auto	man	man	man
CF	water flow	man	auto	man	auto	auto
r1	heating elements	man	man	man	man	man
At	supply temp	man	auto	man	man	man
AH	humidifier	man	auto	man	auto	auto
Lt	low temperature	man	auto	man	auto	auto
ht	high temperature prealarm	man	auto	man	auto	auto
Ht	high temperature	man	auto	man	auto	auto
LH	humidity	man	auto	man	auto	auto
HH	high humidity	man	auto	man	auto	auto
tC	comp. thermal	man	auto	man	man	auto
tF	fan thermal	man	auto	man	man	auto
t1	fan 1 thermal	man	auto	man	man	auto
t2	fan 2 thermal	man	auto	man	man	auto
AL	serious generic	Pb	Pb	Pb	Pb	Pb
FA	smoke-fire	man	auto	man	man	auto
pA	power fail (shelters)	auto	auto	auto	auto	auto
CL	clock	man	man	man	man	man

P6 Delta from the effective set point for low temperature alarm
P7 Delta from the effective set point for high temperature alarm
Sets the alarm threshold for low (Lt) and high (Ht) ambient temperature. This value is specified as a differential in respect to the effective setpoint, considering any compensation operations (see parameters /1, rG, rH, Hc). These alarms, in the case of automatic reset, have an hysteresis of 1 degree and are generated only when the machine is active.
Range P6/P7: 0÷50°C 0÷90°F Def. P6/P7: 10

P8 Delta from set point for low humidity alarm
P9 Delta from set point for high humidity alarm
Sets the alarm threshold for low (LH) and high (HH) ambient humidity. This value is specified as a differential in respect to the effective setpoint. These alarms, in the case of automatic reset, have an hysteresis of 1% and are generated only when the machine is active and if the humidifier is present (for low humidity alarm).
Range P8/P9: 0÷50 %rH Def. P8/P9: 20

PA High/low temperature/humidity alarm delay on start-up
Sets the delay in recognising the high/low temperature and humidity alarms on starting the machine, that is when switching from STAND-BY => ON.
N.B. The low humidity alarm is delayed by the start-up of the humidifier. This avoids low humidity alarms on resetting any humidifier alarms.
Range: 0÷150 min Def.: 20

Pb Type of management of generic alarm input ID5
Sets the type of alarm generated by input ID5 (AL). This function is enabled only with parameter H2= 0 and can be managed even with the machine in stand-by (see table on general parameters P)
Range: 0÷6 flag Def.: 1

PC Generic alarm delay
Sets the delay in activation of the generic alarm ID5 (AL). This delay is refereed to the activation of the alarm itself.
Range: 0÷250s Def.: 60

Pd Return-supply temp. difference for supply temperature alarm

Sets the minimum difference between the return temperature (measured by B1) and the supply temperature (measured by B4) for the activation of the cooling function alarm (At). This alarm has a fixed delay of 4 minutes.

N.B. For alarm At to be generated, the following conditions must all be satisfied:

1. Supply temp. > Return temp. - Pd that is B4 > B1-Pd.
2. At least one compressor on or cooling valve open more than 50%.
3. Both heating elements off or heating valve closed.
4. Delay time of 4 minutes has elapsed.

When this alarm is detected, only the active compressor is blocked.

Range: 0÷20°C 0÷36°F Def.: 3

PE ID4 input selection

If = 1 instead of the heating element thermal overload alarm it activates a smoke-fire alarm.

Range: 0÷1 flag Def.: 0

PF ID49 input selection

If = 1 in the CW machines, it activates a water flow alarm.

Range: 0÷1 flag Def.: 0

PG High temperature prealarm enabling

It enables the "ht" prealarm with a differential from the set equal to P7/2 and hysteresis of 1 degree (in this case it is better to increase the P7 value).

Range: 0÷1 flag Def.: 0

H= general configuration parameters

H1 Machine model

Sets the type of air-conditioning unit to be controlled.

0= ED unit (see par. 4.2)
1= CW unit (see par. 4.1)
2= CW unit (C/H)
3= shelter unit (see par. 4.3)

For models CW and ED, the configuration is determined by parameters H5 and H6; for models CW C/H and shelters, on the other hand, it is set according to the cooling actuators.

CW C/H: machine using refrigerated water with central cooling/heating switching. In heating mode the battery is supplied with hot water, and the cooling valve is used for regulation. Input ID7 performs the switching from heating to cooling and the exchange of the set-point, as follows:

ID7= 24Vac Heating Set= r9
ID7= 0 Cooling Set= r1

When the machine is in cooling mode, the presence and the number of heating elements depends on parameter H6; in heating mode, on the other hand, the cooling actuators are considered absent and the heating elements inhibited.

Shelters: direct expansion machine with 1 compressor, 1 heating element (optional - H6), condensation control, damper management for free-cooling and no power alarm (no humidifier control possible). For the configuration of the inputs and outputs.

Range: 0÷3 flag Def.: 0

H2 Number of machines in rotation

H2 is setting at 0 in stand alone machine. Enables the rotation function of a unit in stand-by within a group of H2 units (H2=1 no meaning). The value of H2 in fact specifies the total number of units connected according to the diagram in par. 4.4 on p. 10. Only one unit is in stand-by, while the others are in operation. Once the time H4 has elapsed, the rotation of the unit in reserve occurs, according to the progressive order of the addresses. If one of the units in operation stops, due to an alarm, the machine in stand-by is automatically re-activated. The alarm condition is detected after a delay of 30s.

Range H2: 0÷6 flags Def. H2: 0

H3 Address of unit in rotation

Specifies the address of the unit; if two units have the same address they are placed in stand-by together. The unit with address 1 is the master, and this unit, with impulses transmitted via digital output Out7, sends the other units the command to switch from ON => STAND-BY and vice-versa. This command is re-sent every 10 minutes.

Range H3: 1÷6 Def. H3: 1

H4 Rotation time between a series of units

Sets the rotation interval, after which the unit off is turned on, while the unit with the subsequent address goes to stand-by. Setting H4= 0 activates test mode, with a rotation time of 2 mins. This operating mode is indicated by the letter "C" in the "day field" on the display.

Range H4: 0÷250 hours Def. H4: 0

H5 Operating mode of the 2 "cooling" outputs Out1/ Out 2
Sets for models ED and CW (H1=1 or 2) the type of cooling actuators connected, see table below.
Range: 1÷5 flags Def.: 1

H6 Operating mode of the 2 "heating" outputs Out 3 / Out4
Sets for models ED and CW (H1=1,2) the type of the heating actuators connected.
0= No heating actuator connected. If the fan is controlled in proportional mode, for temperature values lower than the set point this remains at minimum speed.
1= 1 heating element connected to output OUT3.
2= 2 heating elements connected to outputs OUT3 and OUT4.
3= Three-point valve with opening control connected to output OUT3 and closing to output OUT4.
4= 2 different power heating elements connected to outputs OUT3 and OUT4, the more powerful must be connected to OUT4
Range: 0÷4 flags Def.: 1

H7 Excursion time for 3P valve or damper
Sets the excursion time for the valve or, if the shelter model is chosen, of the damper.
Range: 0÷600s Def.: 150

H8 Humidifier presence
0= humidifier management disabled
1= enable the humidifier management , the generation of corresponding
alarms and the display of the relative symbol.
Range: 0÷1 flag
Def.: 0

H5 Meaning ID7 ID8 ID9 ID10
1 1 compressor on OUT1 High pressure Low pressure Compressor overload Fan overload
2 2 compressors on OUT1 and OUT2 High pressure C1 Low pressure C1 High pressure C2 Low pressure C2
3 Three-point valve with opening OUT1 closing on OUT2 Fan overload
4 2 different power compressors OUT1 OUT2, the more powerful connected to OUT2High pressure C1 Low pressure C1 High pressure C2 Low pressure C2
5 2 compressors in tandem High pressure Low pressure Compressor overload Fan overload

H9 Type of dehumidification
Selects the dehumidification mode.
0, 1= with start-up of compressor 1, 2
2= with start-up of both compressors
3= with capacity-controlled cooling ramp (it active the auotput at 100%)
4= with fan speed reduction
5, 6, 7, 8= combined action 4+0, 4+1, 4+2, 4+3
9= no action
Range: 0÷9 flags
Def.: 0

Heating/cooling valve and damper management

If the actuator for the control of heating or cooling is of a three-point valve, when the instrument is connected to the power supply it goes to PRE-START status: the symbols on the display immediately indicate the status of the actuators required by the regulation, the valves, on the other hand, are completely closed for a period equal to the value set by parameter H7 + 10%. This allows a realignment of the position of the latter before beginning regulation. During normal operation, temperaturecontrol occurs by opening or closing the valve, with minimum variations of 5% of total stroke. If the valve is required to open to more than 90%, the control first completely opens the valve for a period proportional to the total time H7 and longer than that necessary, before returning to the value required. In the same way, if the valve is required to close below 10%, the control completely closes it before returning to the osition of the required value. To adjust for any small valve movements, when the latter is operating either completely open or closed, the control forces the complete opening or closing every 10 minutes, or 60 minutes in stand-by or time band sleep mode, for a period of H7/2 seconds. These procedures, like the complete closing of the valve on instrument start-up, allow the degree of opening of the valve to be accurately calculated, even if there is no direct retroaction between valve and actuator. The same considerations are valid if a motorised damper with 3-point control is used as the cooling actuator in shelter mode.

Condensation control

For direct expansion machines (ED or shelter), output Y2 can be used to control the condensation fans (modules MCHRTF**A0), integrating this function in the regulation of the µAC. For direct expansion machines, temperature probe B2 is used both for one or two compressors; on the other hand, for "shelter" units, the active probe B3 is used, either for pressure or temperature. For the operating diagram, see Fig. 7. The parameters to be selected are Hb, Hc, Ho, as well as the fan parameters "F".

Hc Function of probe B2
0= probe B2 is used for the compensation of the SET POINT.
1= probe B2 is used for free-cooling management, via the 0÷10Vdc output.
2= outputs SSR, OUT3 and OUT4 are used to manage a free-cooling damper with 3-point control.
3= output OUT3 is used to manage an ON-OFF free-cooling damper.
4= probe B2 is used for condensation control.
Range: 0÷3 flags Def.:0

Free-cooling function

In shelter-type units, energy saving can be achieved using a damper on the external air (output Y1 for 0-10Vdc or three-point with outputs out3 and 4, or on-off type with output out3) to control the free-cooling function, using the external probe B2, and setting an activation temperature differential using the parameter rL. In addition, this function is limited by setting a set point rn for the supply temperature B4. For the operating diagrams, see Fig. 6. The parameters to be selected are Hc, rL and rn. The compressor alarms and PA alarm enable the opening of the damper independently of the external temperature.

Hd Function of probe B3
Enables probe B3 as humidity sensor or for the control of condensation pressure.
0= Humidity control
1= Condensation control
Range: 0÷1 flag Def.:0

HE ON/OFF digital input
Enables the digital input ID1 as Remote ON/OFF. With the input open the machine is in stand-by (signalled by the symbol "OFF" on the display); applying, on the other hand, a voltage of 24V the unit is turned on (signalled by the symbol "ON" on the display).
0= Absent
1= Present
Range: 0÷1 flag Def.: 0

HL Parameter sets
Allows various configurations of parameter levels (see table of parameters at the start of chapter 6).
Range: 0÷3 flags Def.:0

Hn Select data shown on display
Selects which values are shown on the display, in normal conditions: temperature and humidity read by the probes or the set point, or, if the clock board is present, the current time. In the latter two cases, pressing the button shows the values read by the probes.
0= Probes B1, B3 (if present)
1= Temperature and humidity set points (if present)
2= Day and time (if clock present)
Range: 0÷2 flags Def.: 0

Ho Supervisory network serial address
Sets the address of the device in the RS485 supervisory network.
Range: 1÷200 Def.:1

HP Supervisory network serial baudrate
Sets the line speed in the RS485 supervisory network.
1= 1200 Baud
2= 2400 Baud
3= 4800 Baud
4= 9600 Baud
5= 19200 Baud
Range: 1÷5 flags Def.: 5

Hr Software version
Displays the software version of the µAC in the format n.nn.

HF Logic of the alarm relay (Out 6)
Selects the logic of the relay, normally energised or de-energised, and the category of alarms which activate this relay.
0= Relay de-energised for all alarms
1= Relay energised for all alarms
2= Relay de-energised only for serious alarms
3= Relay energised only for serious alarms
Range: 0÷3 flags Def.: 0

HG Delay on start-up
Sets the delay time on each switching from stand-by to ON or POWERON. During this phase the green LED is on but all actuators remain off.
Range: 0÷300s Def.:0

HH USER password
Sets the value of the user password to access the User parameters.
Range: 0÷200 Def.:22

Hi Keypad lock
Prevents non-authorised personnel from modifying the parameters.
0= no lock
1= locks all parameter modification, alarm reset and hour counter functions (except for access to the user password and switching off via keypad); the lock symbol appears on the display.
Range: 0÷1 flag Def.:0

CLOCK, TIME BANDS AND ALARM LOG

Functions enabled only with the clock board MAC2CLK000 installed.

Clock

Time display

Pressing the button ⏲ displays the current time and date. Pressing the button once displays the time and the day of the week (1= Monday, 2= Tuesday, ..., 7= Sunday); pressing it again displays the date in the format day-month-year.

Setting the time

First press the 🔲 button (keeping it pressed) and then the **Prg** button, keeping both pressed for 5 seconds. The minutes will begin to flash; use the 🔲 and 🔲 buttons to set the desired time. Use the Sel button, on the other hand, to select, in order, the fields: hours - day of the week - year - month - day of the month. At the end, press the **Prg** button to confirm the modifications made.

5 Sec.

1.   2.

Time bands

Entering the parameter rt (see USER parameter modification) allows the selection of **rt= 1 or 2**, enabling the time band function. Pressing the **Sel** button displays, in sequence, with the scrolling of a segment, time bands 1, 2, 3, 4 of day 1 (Monday), ... , time bands 1, 2, 3, 4 of day 7 (Sunday). The 🔲 and 🔲 buttons allow, with 10 minute steps, the start time of the selected band to be modified, while the **ON/OFF** button enables or disables the action of the band itself, confirmed by the messages ON/OFF on the display.

Copying the time bands

If the times set for the bands are also valid for the following days, these can be simply copied by pressing and holding the **Sel** button for 3 seconds. Once the copy has been made, the following day is automatically displayed: if this too is to be copied, release the **Sel** button and then press it again for a further 3 seconds.

3 Sec.
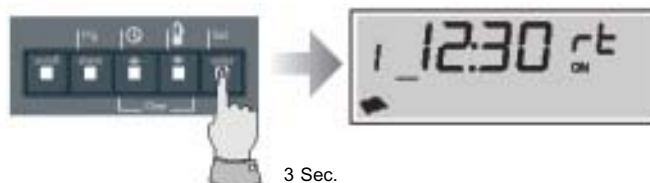
The operating mode controlled by the time bands is indicated by the symbol [A] on the display.

N.B. The ON status controlled by the time bands is only valid if the machine is first activated from the keypad or the remote input (if enabled).
The OFF status controlled by the time bands, displayed by the "half moon" symbol ☽ on the display, acts according to whether parameter
rt is set to 1 or 2:

rt= 1, Sleep mode: during the OFF status, the fan, if controlled proportionally, works at minimum and the actuators remain off.

The machine is reactivated in the following conditions:
a) the temperature exceeds 70% of the high/low alarm threshold,returning to Sleep if the temperature falls within 40% of the alarm delta.
b) the ON/OFF is pressed: in this case the on status lasts until the next time band; during this period the symbol "A" flashes.
rt= 2: the machine is in stand-by, as if the ON/OFF had been pressed. In this case too, pressing the **ON/OFF** button activates the machine until the next band switching OFF time.

Alarm log

In the event of an alarm the alarm code, hour, minute and data are recorded, up to a maximum of 300 signals. On reaching the maximum number the oldest events are deleted (code 1 always indicates the most recent alarm).

Display alarm log
To display the list of alarms recorded, press the [⛨] button, followed by the **Alarm** button.
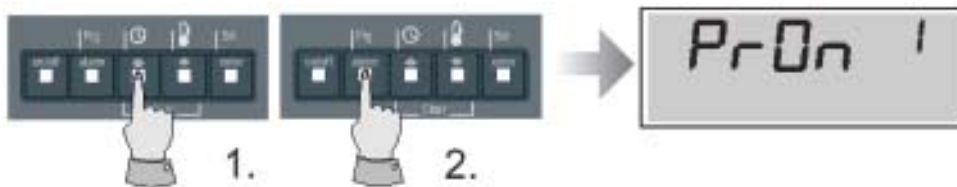
The code of the last alarm event is shown, and, on repeatedly pressing **Sel**, the hour, minute and the date. The [⛨] and [⛨] buttons scroll the alarm data. In places where no alarm has been recorded, dashes are displayed in the place of the code. The display includes an incremental index in the right-hand field, which identifies the current position; the hundreds then appear in the field on the left (e.g.: "1 rES 55" indicates that a reset of the machine was performed, and the position is 155).

Deleting the alarm log
The entire alarm log can be deleted from within the display of log itself, by pressing the ⌷and ⌷ buttons together for 5 seconds. At this point the FACTORY password (177) is required, which, confirmed by enter, leads to the deletion of the log.
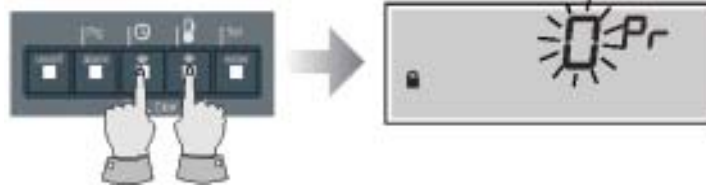
This operation re-initialises the clock board EEPROM and must be performed when installing the board itself. The alarm codes displayed are those reported in the table in the chapter on the alarms; in addition, other special codes have been included to signal the following events:

Code	Meaning
PrOn	Machine re-start after power failure
rES	Manual alarm reset using the Alarm button

Exiting the alarm log
To exit the alarm log menu, press the Alarm button. The menu is exited in any case by time-out, after 60 seconds.

ALARMS AND SIGNALS

In the event of an alarm, the machine performs the following actions:
• activates the buzzer and display ◁)) , (if enabled and machine ON);
• activates the alarm relay (according to parameters HF, HA);
• displays the alarm code and switches on the corresponding red LED.
In this condition, pressing the alarm button silences the buzzer.
The termination of alarms with automatic reset, if no alarms with manual reset are active, brings about:
• the switching off of the buzzer;
• the deactivation of the alarm relay, see parameter HF;

• the switching off of the red alarm LED;
• the re-activation of the actuators switched off by the alarm.
Pressing the ⌷ and ⌷ buttons together for 2 seconds cancels the display of the alarm codes. In the event of alarms with manual reset, pressing the ⌷ and ⌷ buttons together for 2 seconds brings about:
• the deactivation of the alarm relay, see parameter HF;
• the switching off of the red alarm LED;
• the re-activation of the actuators switched off by the alarm.
The maintenance signals for compressors 1 and/or 2, the fan and the filter, due to the exceeding of the hour counter thresholds, activate the symbol ⌦ on the display, the red LED, the buzzer and the alarm relay. The alarm messages are shown cyclically in the order indicated in the following table. On termination, the display of the percentage of humidity (if present) returns for 6 seconds.

Table of alarms

n.	Cod.	Description	Delay	Reset	Buzz.	Alarm Out6	C1 Out1	C2 Out2	R1 Out3	R2 Out4	Sys/ON Out5	Fan Y2
1	E1	probe B1	1 min	P5	ON	ON ⚠	OFF	OFF	OFF	OFF	-	-
2	E2	probe B2	1 min	P5	ON	ON	-	-	-	-	-	-
3	E3	probe B3	1 min	P5	ON	ON	-	-	-	-	-	-
4	E4	probe B4	1 min	P5	ON	ON	-	-	-	-	-	-
5	Er: E	EEPROM boot	imm.	Auto	-	-	OFF	OFF	OFF	OFF	OFF	OFF
6	EE	EEPROM run	imm.	Auto	ON	ON	-	-	-	-	-	-
7	EL	insuff. Power	imm.	Auto	ON	ON	-	-	-	-	-	-
8	H1	high press C1	imm.	Man	ON	ON ⚠	OFF	-	-	-	-	-
9	H2	high press C2	imm.	man	ON	ON ⚠	-	OFF	-	-	-	-
10	L1	low press C1	P3	P5	ON	ON ⚠	OFF	-	-	-	-	-
11	L2	low press C2	P3	P5	ON	ON ⚠	-	OFF	-	-	-	-
12	F1	filter dirty	imm.	P5	ON	ON	-	-	-	-	-	-
13	FL	flow	P1/2	P5	ON	ON ⚠	OFF	OFF	OFF	OFF	OFF	OFF
14	FA	smoke-fire	imm.	P5	ON	ON ⚠	OFF	OFF	OFF	OFF	OFF	OFF
15	CF	water flow	imm.	P5	ON	ON	-	-	-	-	-	-
16	r1	heating elements	imm.	man	ON	ON	-	-	OFF	OFF	-	-
17	At	supply temp	2min	P5	ON	ON ⚠	OFF	OFF	-	-	-	-
18	AH	humidifier	30 s	P5	ON	ON	-	-	-	-	-	-
19	Lt	low temp.	PA	P5	ON	ON	-	-	-	-	-	-
20	Ht	high temp.	PA	P5	ON	ON ⚠	ON	ON	-	-	-	-
21	ht	high temp. prealarm	PA	P5	ON	ON	-	-	-	-	-	-
22	LH	low humid.	PA	P5	ON	ON	-	-	-	-	-	-
23	HH	high humid.	PA	P5	ON	ON	-	-	-	-	-	-
24	tC	comp. thermal	imm.	P5	ON	ON ⚠	OFF	-	-	-	-	-
25	tF	fan thermal	imm.	P5	ON	ON ⚠	OFF	OFF	OFF	OFF	OFF	OFF
26*	t1 / t2	fan 1-2 thermal	imm.	P5	ON	ON	-	-	-	-	OFF(1)	-
28	AL	serious generic	PC	Pb	ON	ON ⚠	OFF	OFF	OFF	OFF	OFF	OFF
29	PA	power fail	2 s	auto	ON	ON ⚠	OFF	-	OFF	-	-	-
30	CL	clock	imm	man	ON	ON	-	-	-	-	-	-
31	n1 + ⌦	counter comp.1	imm.	c9	ON	ON	-	-	-	-	-	-
32	n2 + ⌦	counter comp.2	imm.	cA	ON	ON	-	-	-	-	-	-
33	nF + ⌦	counter filter	imm.	FC	ON	ON	-	-	-	-	-	-
34	nn + ⌦	counter fan	imm.	FA	ON	ON	-	-	-	-	-	-

⚠ = **serious alarms:** in the configuration with two alarm relays, these activate the alarm output; the other alarms, ON the other hand, activate the dehumidification.

Alarm signals

All the alarms, except for the generic external alarm (AL), configured by parameter Pb, and the clock, are detected only when the machine is ON.

E1: ambient temperature probe failure: generated due to open or short-circuited probe. Alarm delayed by 1 minute from the instant the machine is placed ON and when the error is detected. At the moment of detection the control is placed OFF, respecting the configured times, except for the fan.

E2: external air probe failure: generated due to open or short-circuited probe. Alarm delayed by 1 minute from the instant the machine is placed ON and when the error is detected. At the moment of detection the corresponding functions -compensation and free cooling are deactivated. If probe B2 is used for condensation, the fan is forced on at maximum speed.

E3: humidity / pressure probe failure: generated due to open probe and for voltages above 1.15V, if the input is configured as 0÷1V, or, if the input is configured as 4÷20mA, for currents below 3mA and over 23mA. Alarm delayed by 1 minute from the instant the machine is placed ON and when the error is detected. At the moment of detection the corresponding functions are deactivated: - humidity control (humidification, dehumidification); - if probe B3 is used as a pressure sensor, for the control of condensation, and probe B2 is present for reading the external air temperature, the fan is forced on at maximum speed if the temperature measured by B2>15°C. The same is true if probe B2 is not present. - If the temperature B2=15°C, on the other hand, the fan operates at half speed.

E4: supply air temperature probe: generated due to open or short-circuited probe. Alarm delayed by 1 minute from the instant the machine is placed ON and when the error is detected. At the moment of detection the corresponding functions are deactivated: supply temperature alarm management (At), and, if free-cooling is active with control of the supply temperature, the damper is closed.

EE: EEPROM data read/write error.
Can occur also during a reset only if it is not possible to make the correction to the secondary bank. This error does not affect the operation of the regulator.

EL: insufficient power supply during EEPROM write
Data write error to EEPROM due to power failure or power below 13Veff.

H1-H2: high pressure C1-C2
Detected irrespective of the activation of the compressor, and causes its immediate switching off without waiting the corresponding delay times. The alarm H2 is managed only if parameter H5= 2 or 4 (two independent circuits). If condensation fan regulation is present, this is activated for 60 seconds at maximum speed before switching off.

L1-L2: low pressure C1-C2
Detected only with the compressor on, and causes its immediate switching off without waiting the corresponding delay times. The alarm is delayed by P3 seconds on the start-up of the compressor. If automatic reset is set, parameter P5, a compressor restart is attempted 10 times, then the alarm is automatic reset automatically. The alarm L2 is managed only if parameter H5= 2 or 4 (two independent circuits).

F1: dirty filter
Signal-only alarm. No outputs are deactivated.

FL: air flow alarm
Alarm delayed by parameters P1 and P2. The activation of this alarm causes the switching off of all of devices without waiting the delay times of the compressors and the fan. If set for automatic reset, parameter P5, a restart of the outputs is attempted 10 times.

FA: smoke-fire alarm
This alarm can be configured using the PE=1 parameter. If configured, it causes the shutdown of all the actuators without respecting the timings. This alarm is noted with the machine in stand-by too.

CF: water flow
This alarm can be configured, only for CW machines, using the PF=1 parameter. When this alarm occurs, it causes the closing of the cooling valve.

r1: heating element thermal overload alarm
Causes the immediate switching off of the heating elements.

At: high supply temperature alarm (cooling function)
Enabled by the presence of the supply air temperature probe B4 (parameter /2) and by the setting of parameter Pd. The alarm has a fixed delay of 2 minutes, and is activated only if the cooling actuators are on and heating actuators are off. This alarm, when detected, only blocks the compressor on at that moment, while the second compressor remains enabled.

AH: humidifier alarm
Alarm delayed by 30 seconds. If detected, the humidifier output (0÷10Vdc or relay) is deactivated.

Lt: low temperature alarm
Ht: high temperature alarm
These alarms are delayed on the start-up of the regulator (or on exiting stand-by mode) for a period equal to parameter PA, and for 1 minute on exceeding the set threshold. The reset occurs, if programmed as automatic, 1 degree above (Lt) and 1 degree below (Ht) the threshold. In addition, exceeding the high temperature threshold causes the immediate start-up of the compressors without waiting the corresponding delay times.

ht: high temperature prealarm
This alarm can be configured using the PG=1 parameter. This alarm is delayed by the startup of the regulator (or by going out of the stand-by) for a time equal to the parameter PA and of 1 minute from the overcoming of the threshold. If programmed as automatic, the reset occurs 1 degree below the P7/2 threshold.

LH-HH: low-high humidity alarm
These alarms are delayed on start-up (or on exiting stand-by mode) for a period equal to parameter PA, and for 1 minute from exceeding the set threshold. These are signal-only alarms, with an hysteresis of 1% R.H.

tC: compressor thermal overload alarm
Immediate alarm, causes the instant switching off of the compressor. This is managed only if parameter H5= 1 or 5 (one compressor only or two compressors in tandem).

tF: fan thermal overload alarm
Immediate alarm, causes the instant switching off of all devices without respecting the compressor delay times. This is managed only if parameter H5= 1 or 5 (one compressor only or two compressors in tandem).

t1 / t2: fan 1-2 thermal
This alarm can be configured using the HA=6 or 7 parameter. Immediate alarm, it causes the instantaneous shutdown of the connected output:
• **t1=** 1 (ID2) supply fan
• **t2=** 2 (ID2) supply fan
If both of them are ON the flow alarm is forced too turning OFF all the outputs (see description FL).

Machine shut-down signals

These appear in the event of internal machine malfunctions and cause its shut-down. The code is displayed in the ambient temperature (or hour-minutes) field of the LCD display.
Er: C Checksum error during code check in Flash: the control can no longer be used.
Er: E The content of the EEPROM (parameter memory) is damaged. A reset can be attempted by reloading the default values.
Er: L Insufficient power: Power voltage < 13Veff when writing the default values or during an attempt to automatically recovery an EEPROM damaged sector.

AL: generic external alarm
This alarm can be configured by setting parameters Pb and PC. If configured as a serious alarm, it switches off all actuators without respecting the delay times.

PA: shelter power failure alarm
External power failure alarm delayed by 2 seconds. This is generated for models configured as shelters when input ID6 is open; it causes the immediate switching off of the compressor and the heating element, and allows the opening of the damper. It is a priority alarm in respect of the inhibition due to a dehumidification request.

CL: clock failure alarm
Alarm generated by the malfunctioning of the clock board. Interrupts the time band function, and the regulator goes into ON status if even the current band provides an off command. This event does not block the alarm log, which continues to store the signals, however with incorrect time values.

n1: compressor 1 maintenance warning
n2: compressor 2 maintenance warning
Signal-only alarm generated when the hour counter threshold has been exceeded, displayed together with the symbol, see parameters c9 (compressor 1) and cA (compressor 2).

nF: filter maintenance warning
nU: fan maintenance warning
n2: compressor 2 maintenance warning Signal-only alarm generated when the hour counter threshold has been exceeded, displayed together with the symbol, see parameters FC (filters) and FA (fan).

OPTIONAL BOARDS

The μAC is designed for the application of optional boards, depending on requirements.
- RS485 serial board: the μAC can be included in a supervisory or telemaintenance network;
- clock board: enables the clock functions, time bands and alarm log;
- programming key: allows the list of set parameters to be saved and/or copied to other instruments in a quick and reliable manner.

RS485 serial board

In order to use the μAC in an RS485 supervisory or telemaintenance network, the optional RS485 board must be inserted, as follows:
- disconnect power from the μAC;
- insert the RS485 board in the relative connector on the I/O board (see Fig. 3);
- connect the serial line, according to the polarity indicated;
- reconnect power to the μAC.

N.B. The serial line should be terminated with a 120 ohm - 1/4W resistor, between the Tx/Rx terminals of the RS485 board on the μAC at the opposite end of network from the supervisor.

Serial Converter RS 485
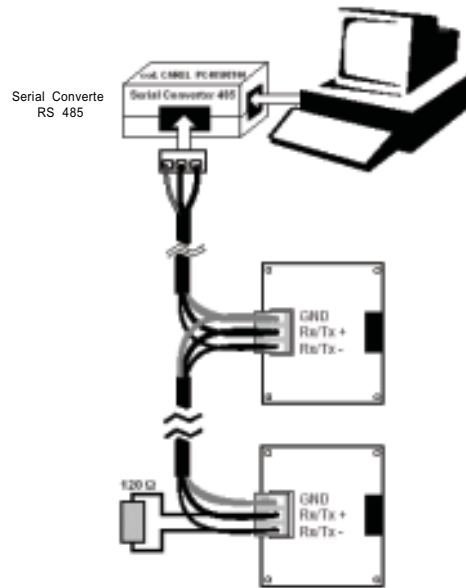
Set up
Set the network address of the μAC using parameter Ho, and the speed using parameter HP, where:

HP	Speed
1	1200
2	2400
3	4800
4	9600
5	19200

RS485 serial board technical specifications
Power supply: from the μAC using plug-in connector
Current consumption: 20mA
Storage conditions.: -10÷70°C, R.H. < 80% non-condensing
Operating conditions: 0÷65°C, R.H. < 80% non-condensing
Dimensions: 46x44 mm
Index of protection: IP00
Environmental pollution: normal
Surface temperature limits: as for operating temperatures
Classification according to protection against electric shock: to be integrated in Class I or II devices
Category of resistance to heat and fire: D
PTI of materials used for insulation: 250V
Serial output: 3-way screw terminal connector for leads with min. cross-section of 0.2 mm$_2$ and max. cross-section of 1.5 mm$_2$

Standard: optically-isolated asynchronous RS485
Maximum speed: 19200 baud
Maximum number of devices: 200
Maximum distance from supervisor: 1 km
Cables: 1 twisted pair and shield, AWG20/22 with capacity between leads < 90pF/m (e.g. BELDEN 8761-8762 cables)
Protection against electric shock: the device guarantees only a functional insulation between the source power supply of the μAC and the serial line, thus the μAC must power supply must feature a safety transformer.

Clock board

To enable the clock, time band and alarm log functions, insert the MAC2CLK000 board and perform the following procedure:
- disconnect power from the μAC;
- insert the MAC2CLK000 on the I/O board (see Fig. 3);
- reconnect power to the regulator;
- set the date and time and delete the alarm log.

TECHNICAL SPECIFICATIONS

Power supply:	24Vac ±15% 50/60Hz
Maximum current consumption:	200mA with internal 800mA T fuse (slow-blow)
Power transformer for µAC and digital inputs:	10VA
Operating range:	Temperature probes -30÷70°C Humidity probe 0÷100% r.H.
Accuracy of measurement (excluding probe):	±0.5°C NTC probes / ±0.005V 0.5% f.s. 0÷1Vdc probe / ±0.02mA 1% f.s. 4÷20mA probe
Resolution:	0.1°C
Operating conditions:	-10T54 (-10÷54°C) with 20÷80% r.H. non-condensing
Storage conditions:	-10T70 (-10÷70°C) with 0÷80% r.H. non-condensing
Analogue inputs:	**B1-B2-B4**, for 3 NTC Carel temperature probes (10K．at 25°C) **B3**, 1 0÷1Vdc/ 4÷20mA input for humidity or pressure probe (selected using rear pin strip) +V, Probe power output 14Vdc 30mA max
Digital inputs:	**ID1-ID10**, 10 inputs not optically isolated from power supply potential G0 powered at 24Vac current consumed by each input 6.5mA at 24Vac. The alarms are active when the corresponding input is open (not powered). Input ID1, for Remote ON/OFF, switches on the machine when powered. Input ID7, for Cooling/heating, enables heating operation when powered.
Analogue outputs:	**Y1**, 0÷10Vdc output not optically isolated from power supply potential G0, maximum load 10mA 1K．**Y2**, 1 phase-cut output for Carel MCHRTF*0A0 regulator, impulsive at mains frequency, configured by user parameters for pulse width modulation (PWM) or position, with loadless voltage of 4.8V ±10% on minimum load of 1K．
Digital outputs:	**OUT1-5**, 5 SSR 24Vac 1A (optically isolated in three groups from G-Go) with minimum current of 20mA. In addition, the 3 groups C1/2-OUT1-OUT2, C3/4-OUT3-OUT4, C5-OUT5 are insulated from each other and this insulation is functional (voltage < 50V). GND and G0 are connected internally. **OUT6-C6**, 1 220Vac relay, switching contact, contacts protected by 250Vac varistors **OUT7-C7**, 1 220Vac relay, normally open contact, contacts protected by 250Vac varistors Max. relay current 2A (resistive and inductive) according to VDE 0631 for 100,000 switchings at 85°C
Max. NTC probe cable length:	50m
Max. digital input cable length:	100m
Max. power output cable length:	100m
Max. fan control output cable length:	50m
Type of action of relay and triac:	1C (micro-switching)
Maximum number of relay switchings:	100,000
Insulation between the relay and low voltage parts:	reinforced
Insulation between the relay and the front panel:	reinforced
Insulation between the two relays:	primary
PTI of materials used for insulation:	250V
Category of resistance to heat and fire:	Category D (self-extinguishing UL94-V0)
Front panel index of protection:	IP55
Environmental pollution:	normal
Period of electrical stress across insulating parts:	long
Software class and structure:	A
Immunity against voltage surges:	Category II
Interfaces:	Pin-strip for optically isolated RS485 serial board MAC2SER000 (optional) Pin-strip for clock board MAC2CLK000 (optional) Connector for programming key Connector for updating microprocessor software
Installation:	Panel mounting, see chapter on Dimensions.
Method of connection:	Connections are made using the four rear connectors. For the connections use the connectors supplied or Carel code MAC2CON001:

Molex® code for the female connectors

	Way
39-01-2080	8
39-01-2120	12
39-01-2180	18

Molex® code for the connector contact Cross-sec. allowed for cables

39-00-0077	AWG16 (1.25mm2)
39-00-0038 (Carel code 5931189AXX)	AWG18-24 (0.90 - 0.35mm2)
39-00-0046	AWG22-28 (0.22 - 0.06 mm2)

For crimping use the relative Molex® tool 69008-0724

Max. no. of connector insertions/removals:	25 cycles

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Improper installation, adjustment, alteration, service or maintenance can cause property damage or personal injury.

Installation and service must be performed by a qualified installer and servicing agency.

CE

TELECOOL-µAC-IOM-0104-E