RPS

User manual

RPS REGULATION

AERMEC

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TABLE OF CONTENTS

1   GENERAL DESCRIPTION

The control provided on the recovery unit RPS entails the management of:
— Exchange of air charged with carbon dioxide and pollutants
— Implement the free cooling bypass under favourable conditions.
— Contain the energy cost increase with the use of a system that recovers large part of the heat contained in the expelled air stream and transfers it to the fresh air.
— Air purification device management
— Modulation of inlet/outlet air flow rate via the VOC probe control (with KVOC800 accessory)

2   CONTROL BOARD INPUT/OUTPUT

The following tables show the control board input/output: the input/output column indicates the input/output how it is called on the board wiring diagram, the Function column indicates how the inputs and outputs are used on the various machines in which the board will be installed, the Electrical characteristics column shows the type of electrical signal that characterises the input/output.

I/O	Function	Electrical characteristics
MC5 1-2	NTC probe input	R(25°C) = 10Kohm, B(25°/50°C)= 3950K
MC5 3-4	NTC probe input	R(25°C) = 10Kohm, B(25°/50°C)= 3950K
MC5 5-6	NTC probe input/ Analog input 0÷10 V	R(25°C) = 10Kohm, B(25°/50°C)= 3950K
MC5 7-8	NTC probe input/ Analog input 4÷20mA	R(25°C) = 10Kohm, B(25°/50°C)= 3950K
M7 1	Digital inputs DI1	V max 3.3 [V] / I max 10 [mA]
M7 2	COM digital inputs	---
M7 3	Digital inputs DI2	V max 3.3 [V] / I max 10 [mA]
M4	RS485 serial port	V max −9 [V] ÷ +14 [V]
M3	TTL serial port	V max 5 [V]
MC2 1	Relay output RL1	V max 230 [V]/ I max 5 [A]
MC2 2	Relay output RL2	V max 230 [V]/ I max 5 [A]
MC2 3	Relay output RL3	V max 230 [V]/ I max 5 [A]
MC2 4	Relay outputs common contact	V max 250 [V]/ I max 15 [A]
MC1	Board power supply input	V max 230 [V]/ I max 1 [A]
MC6 1	Analog output AO1	V max 10.0 [V] / I max 10 [mA]
MC6 2	Analogue outputs common	---
MC6 3	Analog output AO2	V max 10.0 [V] / I max 10 [mA]

3   LED SIGNAL
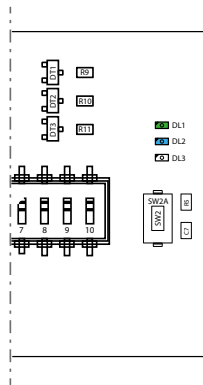
LED	Description
DL1	Always on (indicates that the controller is a master)
	During the self-test it flashes indicating its status
DL2	Presence of alarms in the system
DL3	Flashing indicates correct communication with the user interface

■ *For electrical connection refer to 085E001 wiring.*

4 USING THE SYSTEM

4.1 ACTIVATION OF SELF-TEST FUNCTIONALITY

To make it easier for installers or technical assistance personnel to test the system, a self-test function has been added. To access it, press the SW2 button for about 5 seconds. When the DL1 LED flashes every 2 seconds, the self-test procedure is activated. Each press of the SW2 button enables the operation of the following load:

SW2 key pressure	Load activated	Visualisation DL1
Activation of the procedure with 10 seconds pressure	AO1 output activation (100%)	2 flashes every 2 seconds
1st pressure	AO2 output activation (100%)	3 flashes every 2 seconds
2nd pressure	C1 activation	4 flashes every 2 seconds
3st pressure	C2 activation	5 flashes every 2 seconds
4th pressure	Activation C3	6 flashes every 2 seconds
5th pressure	End of self-test	DL1 off

■ *At the end of the self-test procedure the controller will resume normal operation.*
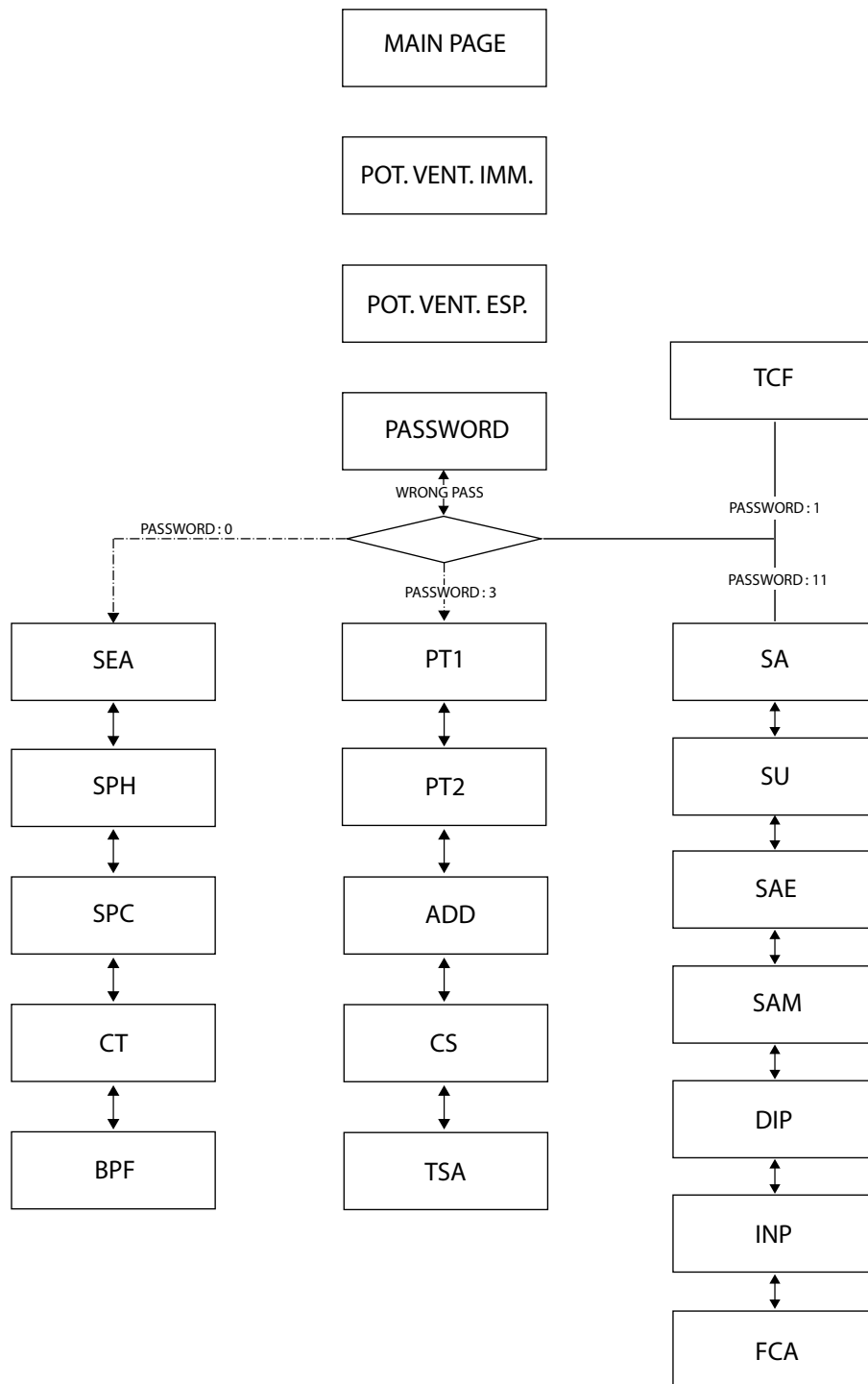
5 INTERFACE USE

5.1 HARDWARE STRUCTURE

The user interface has a monochromatic display and 4 capacitive keys. From this interface one can:
— Set the operating mode
— Set the functioning parameters
— View the reading of all the installed probes
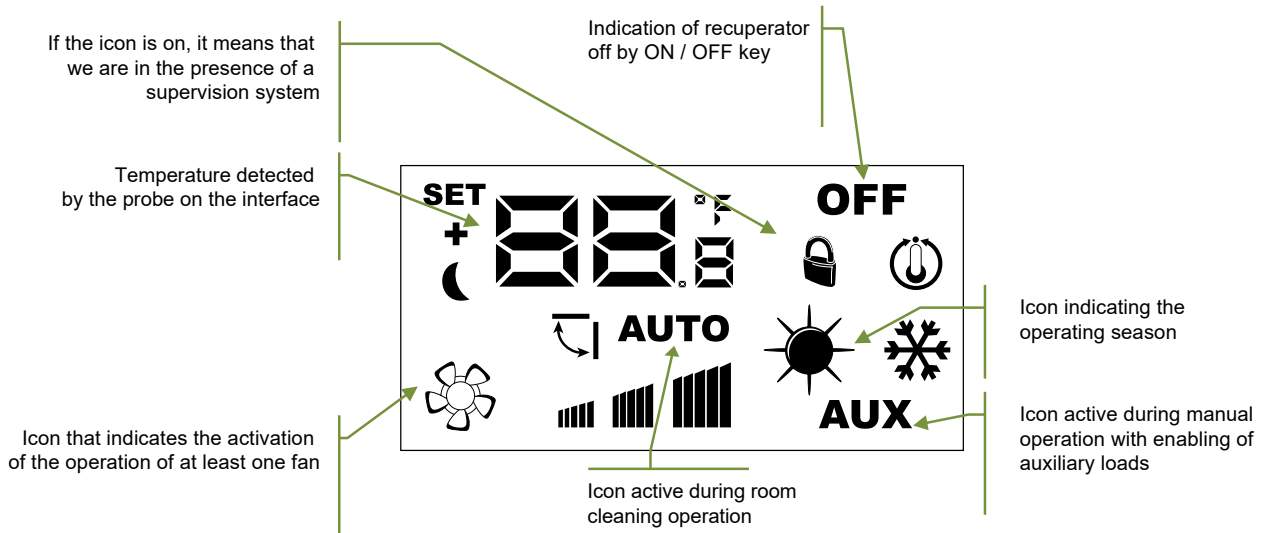— Activate the manual forcing of the electric loads to simplify any troubleshooting

On / Off of the recuperator

Change way
Enable data modification
Confirm data modification

Change page UP
Increment given

Change page DOWN
Decrease given

5.2 SOFTWARE STRUCTURE

```
                              ┌─────────────────┐
                              │   MAIN PAGE     │
                              └─────────────────┘

                              ┌─────────────────┐
                              │  POT. VENT. IMM.│
                              └─────────────────┘

                              ┌─────────────────┐                    ┌─────────────────┐
                              │  POT. VENT. ESP.│                    │       TCF       │
                              └─────────────────┘                    └─────────────────┘

                              ┌─────────────────┐
                              │    PASSWORD     │
                              └─────────────────┘
                                   WRONG PASS
                                      ↕
        PASSWORD : 0          ◇─────────────◇          PASSWORD : 1
    ┌───────────────────────────/             \───────────────────┐
    │                               PASSWORD : 3                    │  PASSWORD : 11
    ↓                                   ↓                           ↓
┌─────────┐                        ┌─────────┐                 ┌─────────┐
│   SEA   │                        │   PT1   │                 │   SA    │
└─────────┘                        └─────────┘                 └─────────┘
    ↕                                   ↕                           ↕
┌─────────┐                        ┌─────────┐                 ┌─────────┐
│   SPH   │                        │   PT2   │                 │   SU    │
└─────────┘                        └─────────┘                 └─────────┘
    ↕                                   ↕                           ↕
┌─────────┐                        ┌─────────┐                 ┌─────────┐
│   SPC   │                        │   ADD   │                 │   SAE   │
└─────────┘                        └─────────┘                 └─────────┘
    ↕                                   ↕                           ↕
┌─────────┐                        ┌─────────┐                 ┌─────────┐
│   CT    │                        │   CS    │                 │   SAM   │
└─────────┘                        └─────────┘                 └─────────┘
    ↕                                   ↕                           ↕
┌─────────┐                        ┌─────────┐                 ┌─────────┐
│   BPF   │                        │   TSA   │                 │   DIP   │
└─────────┘                        └─────────┘                 └─────────┘
                                                                    ↕
                                                               ┌─────────┐
                                                               │   INP   │
                                                               └─────────┘
                                                                    ↕
                                                               ┌─────────┐
                                                               │   FCA   │
                                                               └─────────┘
```
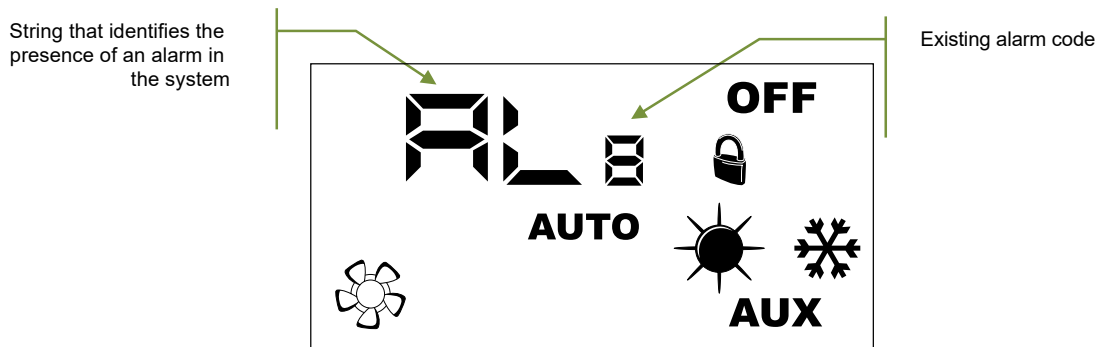
5.3 MAIN PAGE

The main page of the user interface provides essential information on the recovery unit functioning. The following images show all the possible displays on the main page.

If the icon is on, it means that we are in the presence of a supervision system

Indication of recuperator off by ON / OFF key

Temperature detected by the probe on the interface

Icon indicating the operating season

Icon active during manual operation with enabling of auxiliary loads

Icon that indicates the activation of the operation of at least one fan

Icon active during room cleaning operation

Possible views of the Main Page

String that identifies the presence of an alarm in the system

Existing alarm code

Possible views of the Main Page in the presence of an alarm

The list of alarms reported by the user interface is indicated in the "Alarms signal" section. Below is a table that identifies other possible signals that may appear during normal functioning:

☀	❄	Meaning of the indication
Fixed	No present	Winter function
Flashing	No present	Anti-freeze
Fixed	Flashing	Winter function + open freecooling bypass
No present	Fixed	Summer function
No present	Flashing	Summer function + open freecooling bypass

5.4 INPUT FAN POWER PAGE

This parameter identifies the functioning power (expressed as a percentage) of the input fan during the Manual and AUX operating mode.

To enter the modification mode, press the key (the entire data MODE/SELECT modification phase is highlighted by the flashing of the icon), change the value using the keys (V) o (^) and confirm the selection by pressing MODE/SELECT.

Bargraph of the power of the supply fan
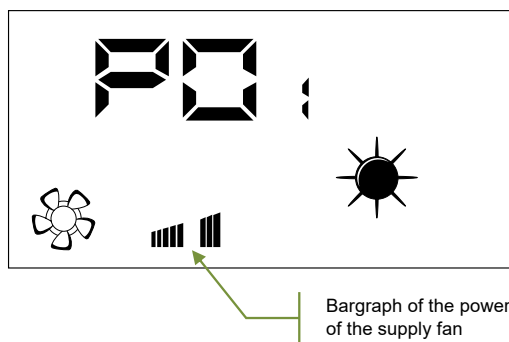
5.5 EXPULSION FAN POWER PAGE

This parameter identifies the functioning power (expressed as a percentage) of the expulsion fan during the Manual and AUX operating mode.

To enter the modification mode, press the key (the entire data $\overset{MODE}{SELECT}$ modification phase is highlighted by the flashing of the icon ⌗), change the value using the keys $\vee$ o $\wedge$ and confirm the selection by pressing $\overset{MODE}{SELECT}$.

Bargraph of the power of the supply fan
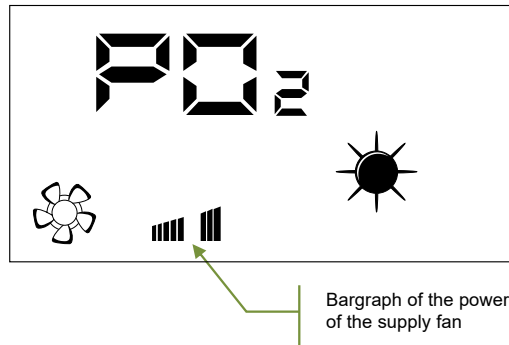
5.6 PASSWORD PAGE

The user can access the submenu parameters through the password setting (see figure below)

| **PASS: 0** | **PASS: 1** | **PASS: 3** | **PASS: 11** |
| USER menu | °C/°F CHOICE menu | INSTALLER menu | ASSISTANCE menu |
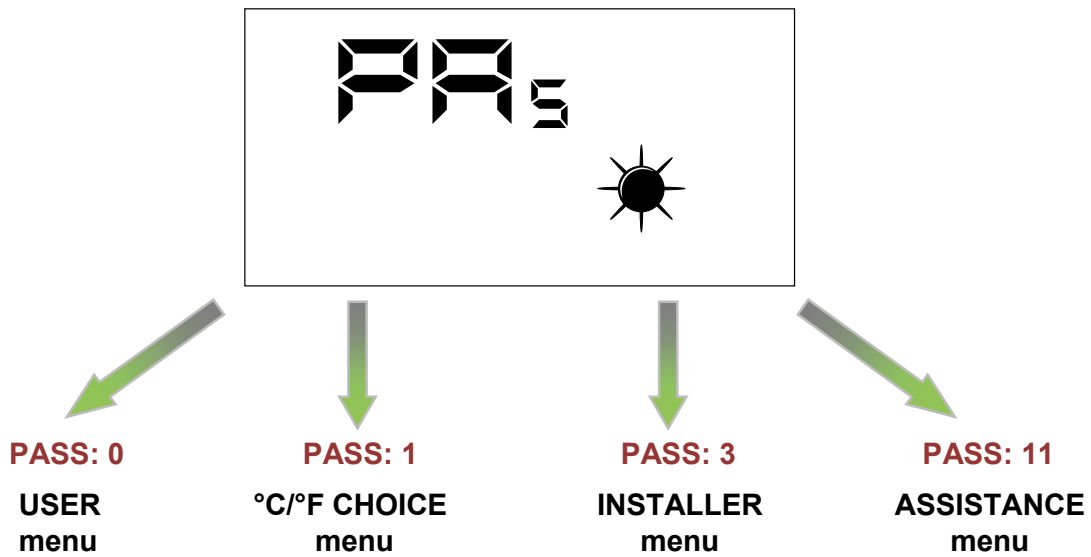
■ *Note:*

to modify all the parameters present in the user interface firmware, simply follow the sequence of operations shown in the figure:

Activate data modification mode   **Set value**   **Confirm data**
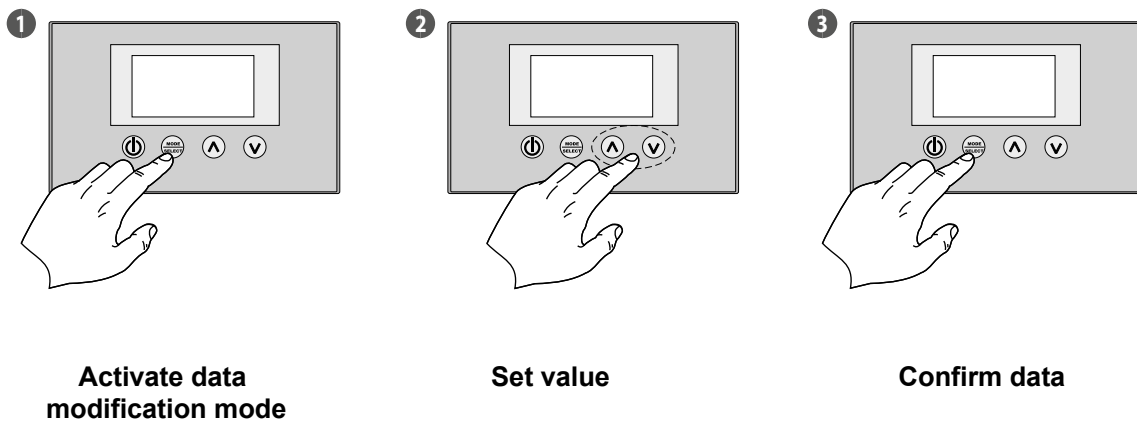
5.7 USER MENU

SEA Parameter

This parameter is used to select the functioning season of the heat recovery unit.
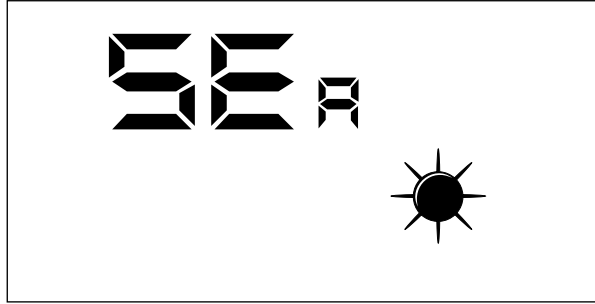
Key:
— SEA: 0 = Summer functioning
— SEA = 1 = Winter functioning

SPH Parameter

This parameter represents the room temperature set desired in the rooms during the winter functioning.
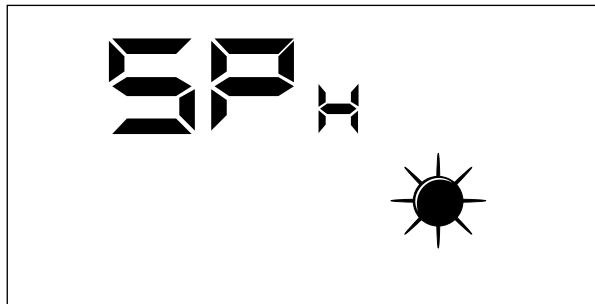
The range of values allowed for this parameter are: 12.0 - 40.0 °C

SPC Parameter

This parameter represents the room temperature set desired in the rooms during the summer functioning.
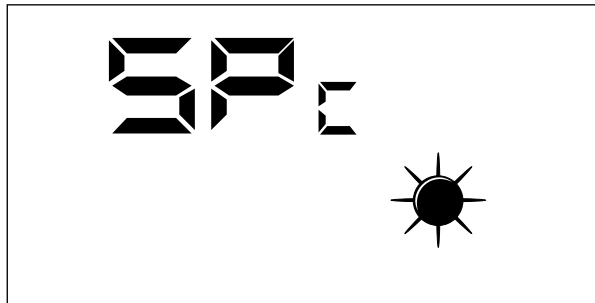
The range of values allowed for this parameter are: 8.0 - 33.0 °C.

CT Parameter

This parameter (cleaning threshold) represents the threshold, expressed as a percentage, of pollutants in the air above which the modulation of the air flow rate processed by the heat recovery unit intervenes to ensure healthy environments.

⚠ **This parameter is only used in the presence of the VOC probe (KVOC800 accessory).**
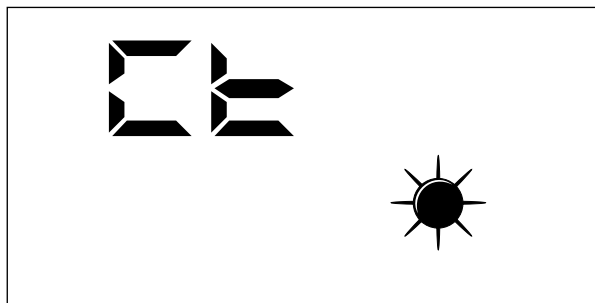
The range of values allowed for this parameter are: 1 ÷ 100%.

BPF Parameter

This parameter enables the user to select the management mode of the freecooling.
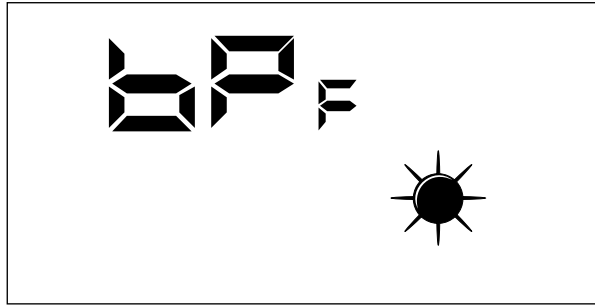
Freecooling bypass management mode:
— BPF: 0 = Freecooling bypass not active
— BPF: 1 = Bypass with 20 minute period
— BPF: 2 = Bypass with 40 minute period

5.8 INSTALLER MENU
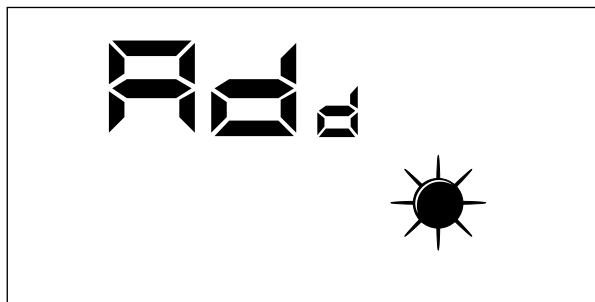
PT1 Parameter

⚠️ **Page not used in this application.**
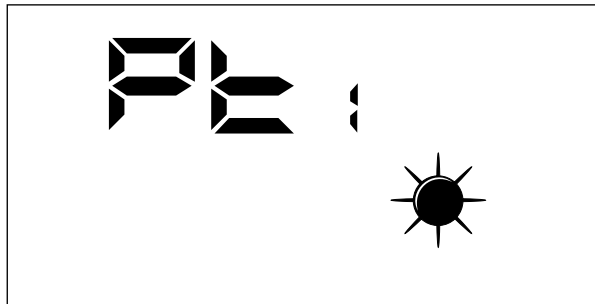
PT2 Parameter

⚠️ **Page not used in this application.**
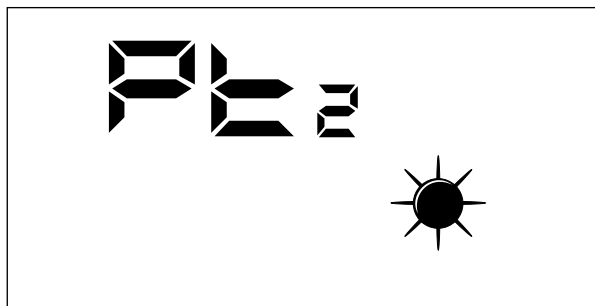
ADD Parameter

This parameter is the serial address of the device for connection to a ModBus RS485 network (the recovery unit can be seen as a slave node of the serial communication).

The range of values allowed for this parameter are: 0 - 255.

■ *Note: the value "0" must not be considered as a usable modbus address, but as a value that disables the serial port of the control board.*

CS Parameter

This parameter allows enabling the writing of some registers through modbus controls by a supervisor or BMS.

```
CS
☀
```
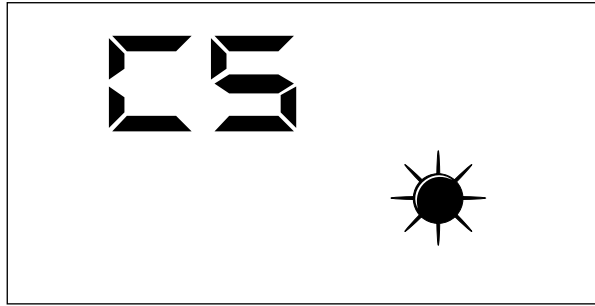
The CS parameter values can be:
— CS: 0 = Writing from modbus serial disabled
— CS: 1 = Writing from modbus serial enabled

TSA Parameter

This parameter allows you to select the operating cycle of the AUTO mode, which concerns air cleaning (forcing the fans to maximum power).

```
TSA
☀
```
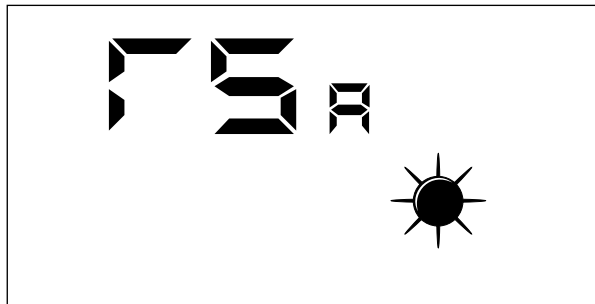
The TSA parameter values can be:
— TSA: 0 = AUTO cycle period of 30 minutes
— TSA: 1 = AUTO cycle period of 60 minutes

5.9   AFTER-SALES ASSISTANCE MENU

The displays that have been introduced in the after-sales assistance menu are addressed to a competent user who knows the hardware structure and the functioning principles of the recovery unit. The display and iteration of the pages in this section allow you to verify the following recovery unit components during the functional testing or machine start-up:
— NTC Probes
— DIP switch setting
— Status of digital inputs
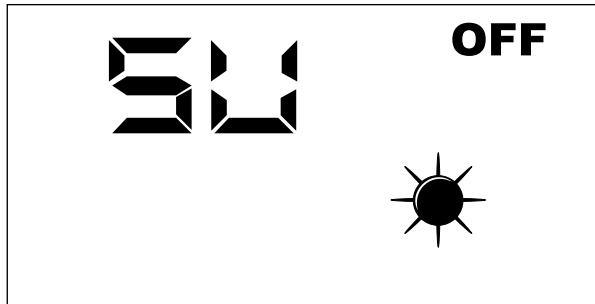— Forcing of load activation and verification of their functioning

SA Parameter

Page for displaying the value detected by the SA probe at room intake.

```
SA          OFF
☀
```
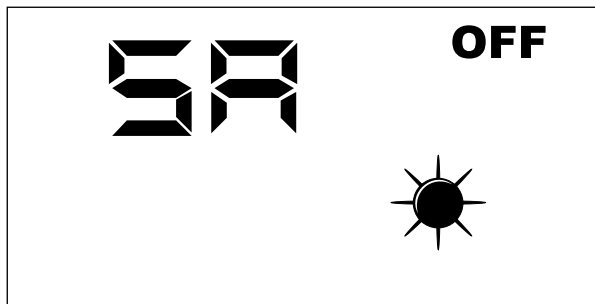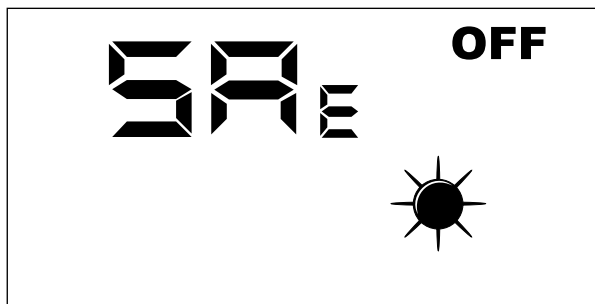
■ *Note: Read only parameter.*

SW Parameter

⚠️ **Page not used in this application.**

```
SU        OFF
          ☀
```

◼ *Note: Read only parameter.*

SAE Parameter

Page for displaying the value detected by the SAE probe for reading the outdoor air temperature.

```
SAe       OFF
          ☀
```
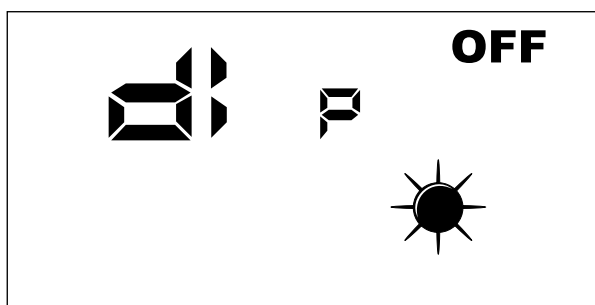
◼ *Note: Read only parameter.*

SAM Parameter

Page for displaying the value detected by the SAM probe for reading the temperature of the air introduced into the room.

```
SAn       OFF
          ☀
```
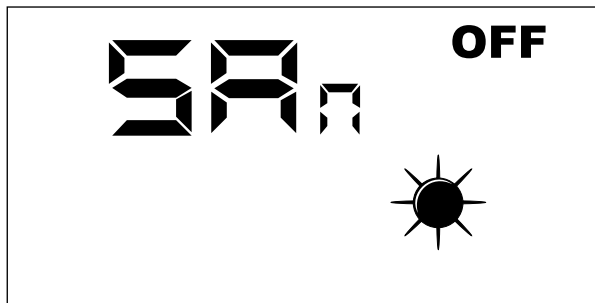
◼ *Note: Read only parameter.*

DIP Parameter

Page for displaying the setting, in decimal format, of the DIP switches on the circuit board.
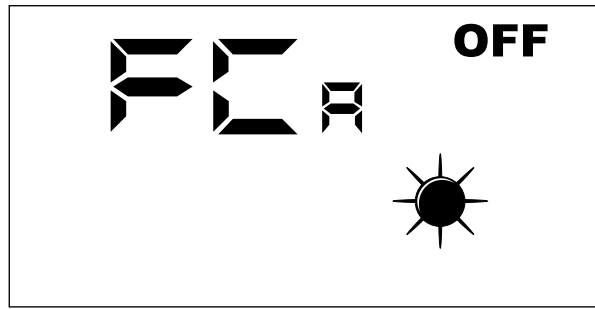
```
dip       OFF
          ☀
```

◼ *Note: Read only parameter.*

INP Parameter

Page not used in this application.

FCA Parameter

Page for the forced activation of the electric loads in the recovery unit and for the reset of the working hours control of the filters.


To activate the desired load, the operator must set the associated value (see the table below). The display shows the data set for the entire duration of the forcing (set by default at 5 seconds). At the end of this time, the FCA value goes back to zero and the load switches off.

Correspondence between FCA parameter and manually activated load

FCA Value	Load activated for 5 seconds
1	Fan 1 at maximum speed
2	Fan 2 at maximum speed
3	Reset filter func. hours alarm
4	Not used
5	Not used
6	Not used
7	Not used
8	LAMP

5.10 °C/°C CHANGE MENU
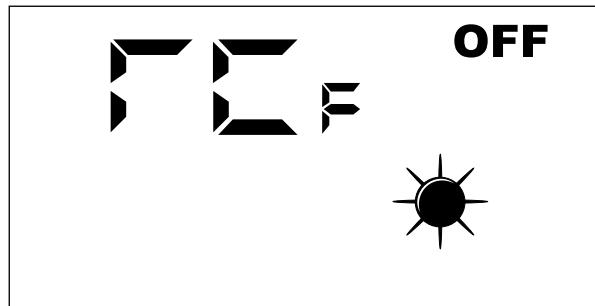
Key:
— 0 = °C
— 1 = °F

5.11 ALARMS SIGNAL

The user interface panel shows some system anomalies with an alphanumeric string, the following table contains all the alarm signals foreseen in the system.

Alarm code	Description
AL0	No communication between the RepControl board and user interface
AL1	Room air probe present in the faulty interface panel
AL2	Faulty F3 fuse
AL3	Faulty F2 fuse
AL4	Faulty SA probe
AL5	Faulty SAM probe
AL6	Faulty SAE probe
AL7	Not used
AL8	Filter cleaning

6   OPERATING MODE

6.1   AUTO MODE

This functioning mode involves the renewal of room air using the maximum flow rate of inflow and expulsion fans. In order to activate this procedure the user must press the ⊙ Mode/Select key on the interface panel until the "AUTO" icon appears.

The duration of this function depends on the TSA parameter (sanification time) settable from the user interface panel of the machine.

TSA = 0 (30 minutes)
TSA = 1 (60 minutes)

When this time expires, the system goes back to the functioning mode that was set prior to the room cleaning procedure.

6.2   MANUAL MODE

This functioning mode involves the activations of inflow and expulsion fans according to the Po1 and Po2 parameters. In order to activate this procedure the user must press the ⊙ Mode/Select key on the interface panel until the "AUTO" and "AUX" icons appear.

The Po1 and Po2 parameters indicate a flow rate percentage (referred to the maximum of the installed fans) to be ensured in a one-hour functioning cycle. These parameters can, therefore, be linked to the air renewal (moved air volume) that is to be ensured to the room.
The control will provide a constant functioning reference such as to ensure a constant instantaneous flow rate:

PISTx = Pox * PMAX

Key:

PISTx: inflow or expulsion instantaneous flow rate
Pox: it can be Po1 or Po2 depending on whether it is the inflow or expulsion fan
PMAX: maximum fan flow rate

6.3   AUX MODE

This operating mode is quite similar to manual mode. In order to activate this procedure the user must press the Mode/Select key ⊙ on the interface panel until the "AUX" icon appears
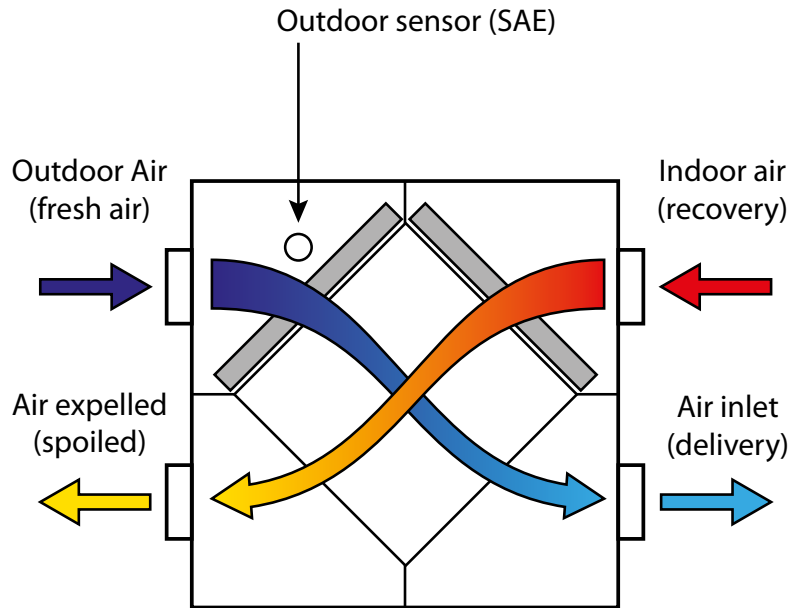
7   CONTROL LOGIC

The table below highlights the control logics enabled for each heat recovery unit functioning mode:

FUNCTION	OPERATING MODE		
	Auto	Manual	Aux
Anti-freeze through flow rate modulation	x	x	x
Freecooling		x	x
Steriliser lamp activation	x	x	x
Room air cleaning function	x		
Door modulation via VOC probe signal		x	x

7.1 ANTI-FREEZE THROUGH FLOW RATE MODULATION

During winter functioning, the recovery unit provides for the modulation of the air flow rate introduced so as to prevent the formation of frost in the exchanger and the extension of the operating limit up to -10 [°C] of outdoor air.

Outdoor sensor (SAE)

Outdoor Air
(fresh air)

Indoor air
(recovery)

Air expelled
(spoiled)

Air inlet
(delivery)

■ *Note: the image shows the unit RPLI, but only for illustrative purposes. The operating logic remains unchanged.*

The fresh flow rate modulation is functionally linked to the TSAE according to the following relationships:

PI = Po1 * PMAX * Ci(T)

Where "Ci" is the correction of the inlet flow rate in relation to the outdoor air temperature (curve highlighted in the following paragraph)

T_{SAE}
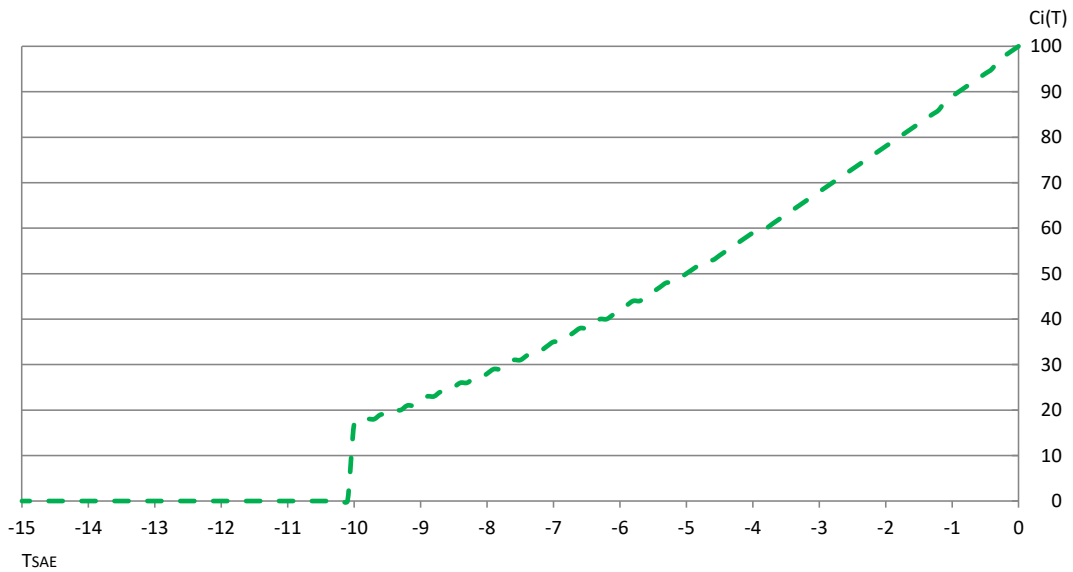
7.2 FREECOOLING

The regulation logic provides for the cooling function through the intake of untreated outdoor air, this function can only be performed through air intake and exhaust cycles.

For the freecooling function to activate, the regulation must instantly control the 3 variables:
— ROOM TSET: room set
— TSAE: outdoor air temperature
— TAMBIENTE: room temperature

If the indoor temperatures exceed the set and, if the TSAE is lower than the TSET, the recovery unit tends to restore the conditions wanted by the user through the inlet of untreated outdoor air, to meet this requirement the control board provides for alternating operation cycles of the intake and exhaust fans. The functioning period of the fans can be 20/40 minutes and can be selected through the BPF parameter.

Freecooling operation
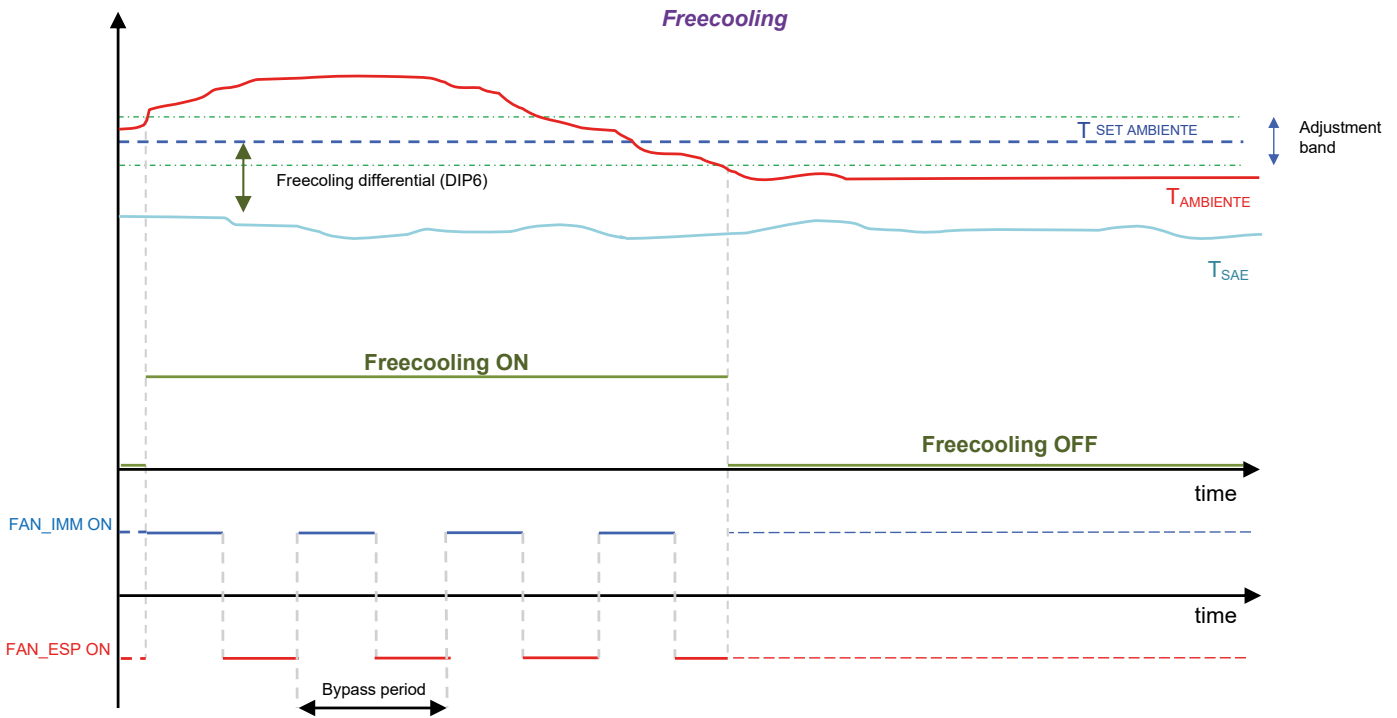
7.3 STERILISER LAMP

The air purification accessory is turned on when the inlet fan is activated to ensure sanitising of the air flowing into the environment.

7.4 VENTILATION MODULATION

In order to optimise the power consumption required for the air exchange of rooms, in the presence of a VOC probe (KVOC800 accessory), an air flow modulation function can be activated in relation to air quality.
This function can be used:
1. In the presence of the VOC probe
2. When the regulator is operating in manual or AUX mode.

The algorithm provides for a one-minute interval:
— To increase the flow rate of intake and exhaust air if the air quality data (expressed in %) is higher than the threshold value set in parameter "Ct".
— Gradually bring the flow rate of intake and exhaust air back to the values defined by the parameters P01 and P02 if the air quality data (expressed in %) is below the threshold value set in parameter "Ct".

Benefits of the function: energy saving and acoustic comfort as intake and exhaust flow rates can be parameterised (parameters P01 and P02) at very low values that ensure minimal turnover.
Only when the rooms have occupancy and utilisation conditions that make the room air unhealthy and with pollutant gas concentrations above the desired threshold is the flow rate of air processed by the recovery unit increased.

8   SUPERVISION SERIAL

This adjustment standard requires the management of the RS485 serial with which they can be connected as slave to a modbus network. The communication parameters are:
— Modbus RTU
— Baud Rate 19200 bit/s
— Stop bits 2
— No Parity

The following modbus data can be read/written by a supervision system:

Modbus variables in the application

LABEL	Description	Use		Values		Unit	ADD
		0x03	0x10/0x06	Min	Max		
STATO_BMS	Machine status	Yes	Yes	0	1	---	0
MODE_BMS	Locally set functioning mode value	Yes	Yes	1	3	---	1
SEASON_BMS	Operating season	Yes	Yes	0	1	---	2
POW1_BMS	Parameterised fan 1 power	Yes	Yes	0	100	%	3
POW2_BMS	Parameterised fan 2 power	Yes	Yes	0	100	%	4
SETC_BMS	Cold adjustment setpoint value	Yes	Yes	80	330	°C/10	5
SETH_BMS	Hot adjustment setpoint value	Yes	Yes	120	400	°C/10	6
FREECOOLING_BMS	Freecooling Parameter	Yes	Yes	0	2	---	7
VOC_THRESHOLD	VOC activation threshold	Yes	Yes	0	100	%	8
SA_BMS	Exhaust ambient air probe	Yes	No	-99	700	°C/10	9
SAE_BMS	External air sensor	Yes	No	-99	700	°C/10	10
SAM_BMS	Intake air probe	Yes	No	-99	700	°C/10	11
SAEXIT_BMS	Not used	---	---	---	---	---	---
VOC_BMS	Air quality probe	Yes	No	0	100	%	13
SV_BMS	Not used	---	---	---	---	---	---
SVC_BMS	Not used	---	---	---	---	---	---
SAT_BMS	Not used	---	---	---	---	---	---
SINT_BMS	Value read by the probe in the user interface	Yes	No	-99	700	°C/10	17
HH_FILTRO	Filter operating hours	Yes	No	0	65536	Hours	18
ALARM_BMS	Alarms found on the recovery unit	Yes	No	0	127	---	19
DIP_BMS	DIP switch configuration	Yes	No	0	1023	---	20
DIP_EXP_BMS	Not used	---	---	---	---	---	---
DIGIN_BMS	Status of digital inputs	Yes	No	0	119	---	22
RELE_BMS	Status of electronic board relays	Yes	No	0	119	---	23
OUT_A01_BMS	Analogue output A01	Yes	No	0	100	%	24
OUT_A02_BMS	Analogue output A02	Yes	No	0	100	%	25
OUT_A01_EXP_BMS	Not used	---	---	---	---	---	---
OUT_A02_EXP_BMS	Not used	---	---	---	---	---	---
S_V_BMS	Software version	Yes	No	0	999	---	28
PT1_BMS	Not used	---	---	---	---	---	---
PT2_BMS	Not used	---	---	---	---	---	---
TSA_BMS	Selection of ambient air cleaning time 0 -> 1/2 hour 1 -> 1 hour	Yes	No	0	1	---	31

■ *Note: each data modification made by BMS is followed by the storage in eeprom of the value.*

STATO_BMS
The variable "BMS_STATUS" indicates the enable status of the regulator and can take on two values:
— 0: Not enabled to function
— 1: Enabled to function

MODE_BMS
The variable "BMS_MODE" represents the operating mode of the regulator and can take on three values:
— 1: Manual mode
— 2: AUX mode
— 3: AUTO mode

SEASON_BMS
The variable "BMS_SEASON" indicates the operating season of the regulator and can take on two values:
— 0: Ssummer functioning mode
— 1: Winter functioning mode

POW1_BMS
The variable "BMS_POW1" represents the operating speed at which you want the inlet fan to work when in manual or AUX mode.

POW2_BMS
The variable "BMS_POW2" represents the operating speed at which you want the exhaust fan to work when in manual or AUX mode.

SETC_BMS
The variable 'SETC_BMS' represents the operating setpoint used by the controller during summer operation.

SETH_BMS
The variable 'SETH_BMS' represents the operating setpoint used by the controller during winter operation.

FREECOOLING_BMS
The variable FREECOOLING can take 3 values:
— 0: Freecooling not enabled
— 1: Freecooling enabled and in the case of freecooling on flow alternation, the 2-minute running period is imposed
— 2: Freecooling enabled and in the case of freecooling on flow alternation, the 4-minute running period is imposed

ALARM_BMS

The variable "BMS_ALARM" indicates the faults in the system, with each bit being associated with a precise indication:
— Bit 0: Filter cleaning or pressure switch input alarm
— Bit 1: Communication alarm with slave board
— Bit 2: Outdoor air probe alarm
— Bit 3: Intake air probe alarm
— Bit 4: Exhaust air probe alarm
— Bit 5: VOC probe alarm

DIGIN_BMS

The variable "DIGIN_BMS" indicates the status of the digital inputs on the boards, with each bit being associated with a precise indication:
— Bit 0: DI1 board
— Bit 1: DI2 board
— Bit 2: board key status

RELE_BMS

The variable "BMS_RELAY" indicates the status of the digital inputs on the boards, with each bit being associated with a precise indication:
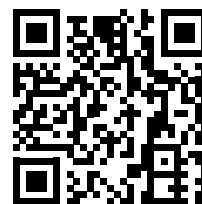— Bit 0: Relay 1
— Bit 1: Relay 2
— Bit 2: Relay 3
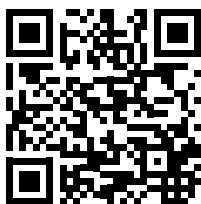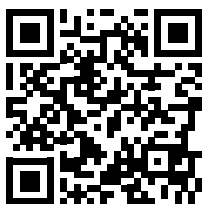
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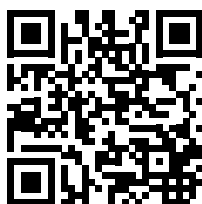Tel. +39 0442 633 111 - Fax +39 0442 93577
marketing@aermec.com - www.aermec.com
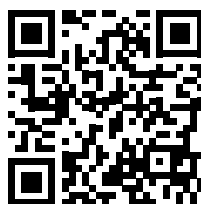
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