MAKING MODERN LIVING POSSIBLE

Danfoss Electronics spa

Air handling Seq. control algorithm

Software version 2.1

REFRIGERATION &
AIR CONDITIONING DIVISION

User manual

Index

1| *Introduction*

The algorithm is aimed at controlling the main types of air treatment units.

It can run on the entire line of MCX systems and envisages the use of a remote MMI interface, Modbus communication and EXC06 expansion.

It can handle the following main functions:

- control of heating and cooling coils using PID logic and cascade control;
- control of fans according to air pressure using PID logic;
- humidity control;
- air quality control;
- "freecooling" and "freeheating";
- energy recovery;
- limiting of supply temperature and humidity;
- management of ON/OFF, 3-point, 0/10V valves;
- management of ON/OFF and 0/10V dampers;
- frost protection.

The type of AHU to be controlled is defined by configuring the parameters and defining the inputs and outputs to be used to control the various elements that make up the AHU.

Both the parameters and the inputs and outputs can be configured from the instrument user interface or from a PC using the Configurator software "AHU_Interface_vNN.xls" supplied with the algorithm (see "17] APPENDIX – Use of the Configurator").*

** In the latter case, it is possible to generate as many binary application files as the number of configurations desired and, after loading them into the MMIMYK accessory, select the configuration to download onto the MCX on a case-by-case basis.*

2| User interface

2.1| Keyboard

Key	Function
	Up
	Down
	Enter
	Esc

Keys are used to access directly some special functions and to navigate through the user interface menu.

2.1.1| Direct access to special functions

for 1s: access the alarms screen (see "2.4.1] Displaying and managing alarms").

for 3s: access the main setpoint (see "6.4] Main setpoint").

for 1s: access the menu.

for 3s: switch between ON/OFF status (see "2.2] Turning the unit ON and OFF").

2.1.2| Menu navigation

Press for 1s to access the menu. Use the and keys to navigate through the menu; pressing lets you descend a level in the menu, if this is possible, and pressing lets you move up a level.

Use the following keys to modify the selected parameters: , to enter the modification mode, and to modify the value, to confirm the modification and to abandon it without confirming.

2.2| Turning the unit ON and OFF

The instrument can be switched from OFF to ON and vice versa in the following ways:

- » pressing the key and keeping it pressed for 3s;
- » using the digital "ONF - ON/OFF" input, if present; remember, the digital input acts on the status change.;*

Note

** if, during the input configuration phase, you set "Polarity"=N.C., the unit is OFF when the input is open;*

- » from a Modbus supervisor through coil 129, (see "16.1] Table of exported variables").

When OFF, the machine mode is indicated as OFF on the main screen.

Passing from OFF to ON turns on the main screen.

Activating of the digital and analog outputs is delayed, respectively, by the dOt and AOt times

UNIT ON AND OFF								
GEN			**General**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	ODL		**Out Delay**					
		dOt	Digital output delay	0	9999	10	sec	
		AOt	Analog output delay	0	9999	10	sec	

Tab.1_[User interface - Unit on and off]

2.3| *Main screen*

From the main screen, press and keep it pressed for 1 second to access the menu (see "2.4] Menu-based navigation").

Note

**After five minutes of inactivity, the main screen is automatically shown.*

The main screen varies depending on whether a LED or LCD display is being used.

2.3.1| *LED Display*

Fig 1_[User interface - LED display]

LED DISPLAY								
GEN			**General**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	dSP		**Out Delay**					
		dSA	Display A value	1	17	RET		;NO;StH;StC;SUP;REt;OUt;tH1;tH2 ;tC1;tC2;bAR;SHU;RHU;OHU;THU ;CO2;VOC
		dUA	Unit of measure A	1	4	°C		;NO;°C ;RH%;bAR
		dSb	Display B value	1	17	StH		;NO;StH;StC;SUP;REt;OUt;tH1;tH2 ;tC1;tC2;bAR;SHU;RHU;OHU;THU ;CO2;VOC
		dUb	Unit of measure B	1	4	°C		;NO;°C ;RH%;bAR

Tab 2 _ [User interface -LED display]

Using dSA and dSB, you can choose which setpoint and probe reading values are to be shown on displays A and B respectively.

dUA and dUb establishes the unit of measure used on the display A and B . The choices are: none, °C, RH%, bar.

The meaning of the icons is indicated in the figure.

The icon associated with a given function follows the trend in activation/deactivation for that function.

2.3.2| LCD Display

The first screen displays:

» the measurement detected by the two analog inputs (see "display A" and "display B" for the version with LED display);

» the symbols of the main active functions (see figure).

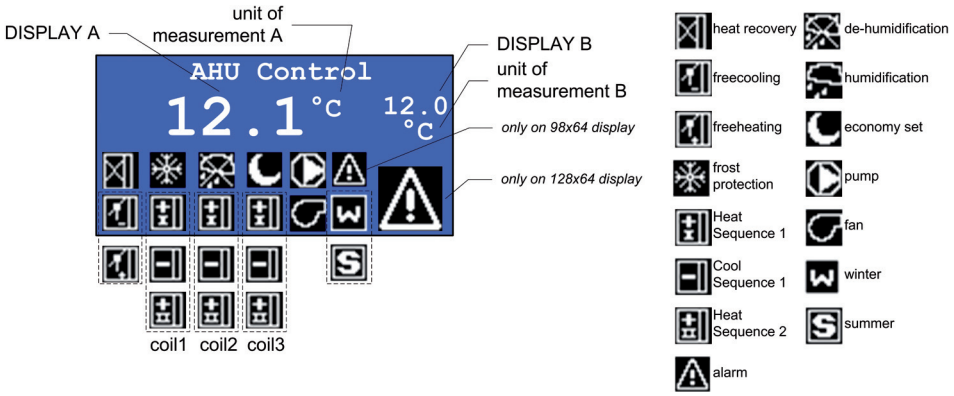

Fig 2 _ [User interface - LCD display]

2.4| *Menu-based navigation*

Press ↵ for 1 second to access the menu described in the table below.

MENU-BASED NAVIGATION							
Menu		**Submenu**		**Submenu**		**Function**	**Notes**
LED code	**LCD description**	**LED code**	**LCD description**	**LED code**	**LCD description**		
ALA	Alarms					Accesses the alarms menu	
		AAL	Active			Lists all currently active alarms	
		SAL	Historic			Presents the alarms history	
		RAL	Reset			Used to reset alarms that are reset manually	
LOG	Login					Login	Specifies the degree of access to menus and parameters. The password is the one indicated by the parameters L01, L02 and L03
PAR	Parameters					Accesses the parameters menu	You must login first. For a description of the parameters menu, (see "15 Parameters")
		….				Parameters menu	See the Configurator software AHU_ Interface_vNN.xls
IO	Input/Output						
		IOd	I/O Values			Displays the input and output values	
		IOC	I/O Config			Accesses the input/ output configuration menu	(only if enabled through the Configurator Software)
				dI	Digital Input	Configuration of the digital inputs	
				dO	Digital Output	Configuration of the digital outputs	
				AI	Analog Input	Configuration of the analog inputs	
				AO	Analog Output	Configuration of the analog outputs	
Utl	Utilities					Accesses the utilities function	
		COM	Commissioning			Enable commissioning screen	
		DEF	Load Default			Load default parameters	
		RTC	Clock Setup			Set date and hour	Only for models fitted with real time clock
		LON	Lock Fan			Stop and lock fans	
		LOF	Unlock Fan			Unlock fans	
		WIN	Winter			Sets the winter operating mode	
		SUM	Summer			Sets the summer operating mode	

Tab 3 _ [User interface -Menu-based navigation]

Use the ↑ and ↓ keys to navigate through the menu; pressing ↵ lets you descend a level in the menu, if this is possible, and pressing ✕ lets you move up a level.

Use the following keys to modify the selected parameters: ↵, to enter the modification mode, ↑ and ↓ to modify the value, ↵ to confirm the modification and ✕ to abandon it without confirming.

2.4.1| *Displaying and managing alarms*

Menu: ALA – Alarms

Sub-menu: AAL – Active

Displays the active alarms.

Screen with description of the alarm (LCD), alarm code and number of active alarms.

Note that you can go to the alarm screen pressing the ↑ key directly from the main screen.

Each screen is dedicated to a specific alarm. Use the ↑ and ↓ keys to move from one screen to the next.

Press ↵ to reset the alarm currently displayed. To reset all alarms keep ↵ pressed for 5 seconds or use the sub-menu "RAL – Reset".

Sub-menu: SAL – History

Displays the history of the alarms which are no longer active.

The screens present the alarm code, description (LCD) and duration in days, hours, minutes and seconds.

Each screen is dedicated to a specific alarm. Use the ↑ and ↓ keys to move from one screen to the next.

Pressing the ↓+↵ keys simultaneously voids the alarms history.

2.4.2| *Login*

Menu: LOG – Login

Insert the 4-digit password that defines the level of access to the menus and parameters.

Press ↑ and ↓ to modify the value of the digit selected.

Press ↵ to confirm the value and move on to the next digit, if present, or to login.

The LEFT and RIGHT keys, if present, make it possible to move the cursor to the desired digit.

The passwords for access levels 1 through 3 are defined, respectively with parameters L01, L02 and L03.

LOGIN								
GEN			**General**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	pas		**Password**					
		L01	Level 1	0	9999	0		
		L02	Level 2	0	9999	2000		
		L03	Level 3	0	9999	3000		

Tab 4 _ [User interface - Menu-LOG - Login]

Note

**If you have not logged in, the access level is 0. This level does not let you display any parameters and menus belonging to higher access levels. The level for a given menu and the parameters is defined through the Configurator software."AHU_Interface_vNN.xls".*

2.4.3| Parameters

Menu: PAR - Parameters

Provides access to the parameters.

For a description of the parameters management submenus, (see chapter "15] Parameters").

2.4.4| Displaying the input/output values

Menu: IO – Input/Output

Sub-menu: IOd – I/O Values

LED Display

The input and output values are displayed in sequence (and), indicating the input/output tags on display A ("AI" for analog inputs; "AO" for analog outputs; "dI" for digital inputs and "dO" for digital outputs) while the value is shown on display B (analog inputs which are not present or are in alarm mode are indicated with ----).

LCD Display

It is used to call up the three screens that display all inputs and outputs; each screen can display a group of 8 I/O. Use the and keys to move from one screen to the next. The second and third screens are only for the MCX15 and MCX20.

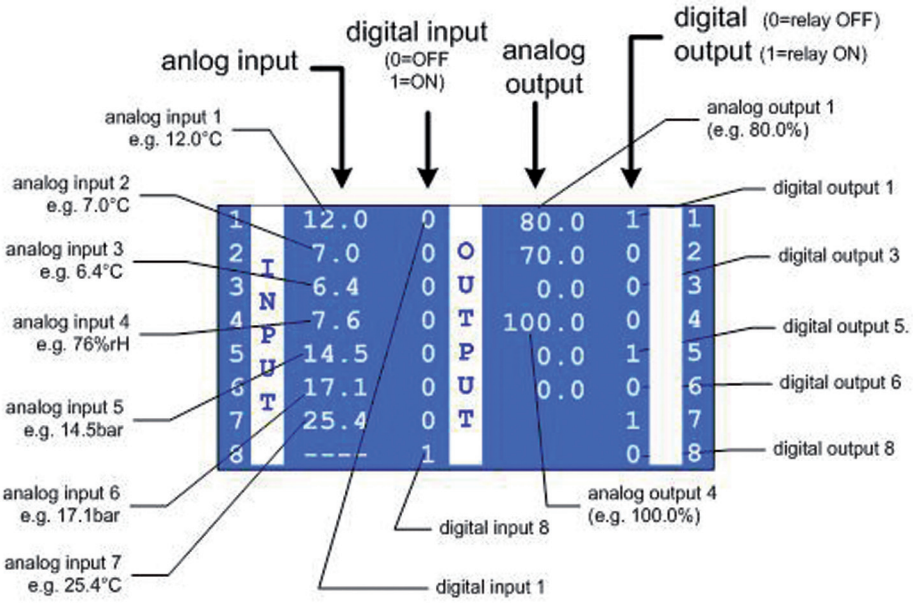

Fig 3 _ [Menu-based navigation - Displaying the input&output values]

Sub-menu: IOC – I/O Config

If enabled through the Configurator software, makes it possible to access the input/output configuration screens.

For each input/output for the instrument, it is possible to set the type, work field, polarity and function performed.

2.4.5| Utilities

Menu: Utl – Utilities

Sub-menu: COM – Commissioning

Enable the commissioning screen.

A new screen is enabled with detailed information on the unit status. By pressing the ↑ and ↓ keys you switch among the following sets of information

Sub-menu: DEF – Load Default

Load default parameters.

Sub-menu: RTC – Real Time Clock

Sets date and time on models fitted with real time clock

Press ↑ and ↓ to select a field. Press ↵ to start modifying the value. Press ↑ and ↓ to change the value. Press ↵ to confirm the change or ✕ to exit without saving it.

Sub-menu: LON – Lock fan

Stop and lock fans

Sub-menu: LOF – Unlock fan

Unlock fans

Sub-menu: WIN – Winter

Sets the winter operating mode.

Sub-menu: SUM – Summer

Sets the summer operating mode.

Screens description

MCX screens / **Values description**

DAMPER SEQUENCE															
P	B				,			P	%					,	
F	C				,			F	H					,	
P	1				,			P	2					,	

Damper Sequence	
control probe	power out
freecool active set	freeheat active set
changeover probe 1	changeover probe 2

HEATS 1								HEATS 2							
P	B				,			P	B					,	
S	T				,			S	T					,	
P	%				,			P	%					,	

Heat Sequence 1	Heat Sequence 2
control probe	control probe
active set	active set
power out	power out

CS1								HUMIDIF.							
P	B				,			P	B					,	
S	T				,			S	T					,	
P	%				,			P	%					,	

Cool Sequence 1	Humidification
control probe	control probe
active set	active set
power out	power out

SUPPLY LIMITS															
T	L				,			H	L					,	
T	H				,			H	H					,	
					,									,	

Supply Limits	
supply temp. low limit power	supply humidity low limit power
supply temp. high limit power	supply humidity high limit power
reserved	reserved

CASCADE CONTROL															
T	R				,			T	S					,	
S	H				,			S	H	U				,	
S	C				,			S	U	C				,	

Cascade Control	
return temperature	supply temperature
return set heat	supply set heat
return set cool	supply set cool

DEHUMIDIFICATION															
P	B				,			T	C					,	
S	T				,			D	W					,	
P	%				,			C	P	%				,	

Dehumidification	
control probe	cooling probe
max humidity set	dew point
dehumidification power	cool seq. 1 power by dehum

FROST PROTECTION															
P	B				,			P	B					,	
S	T				,			S	T					,	
P	%				,			P	%					,	

Frost Protection	
TC1 probe	Control probe
Setpoint OFF	Setpoint ON
Antifrost power in OFF	Antifrost power

POWER MANAGER [%]															
H	1	P						D	E	H	P				
H	2	P						H	U	M	P				
C	1	P						R	E	C	P				

Power Manager	
Heat seq. 1 power	Dehumidification power
Heat seq. 2 power	Humidification power
Cool seq. 1 power	Recovery (Mixing) power

Tab 5 _ [Menu-based navigation - Screen description]

3| Configuring the AHU software

The type of AHU to be controlled is defined by configuring the parameters described later in the manual and defining the inputs and outputs to be used to control the various elements that make up the AHU.

Both the parameters and the inputs and outputs can be configured from the instrument user interface (see "2] User interface") or from a PC using the Configurator software "AHU_Interface_vNN.xls" supplied with the algorithm (see "17] APPENDIX – Use of the Configurator" at the end of this manual).

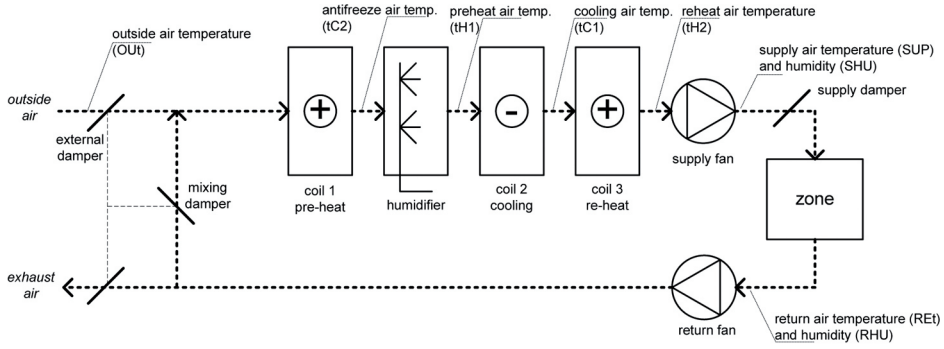

Fig 4 _ [Configuriong the AHU software- AHU software]

3.1| Configuration overview

The main steps to adapt the AHU software to your application are as follows

1. Using the Configurator software "AHU_Interface_vNN.xls" define the input and output you need. (See "3.2] Input/Output configuration" for the list of all the input and output available).
2. Temperature control.
   Assign a temperature control sequence to each of your heating/cooling coils and the actuator type (See "4] Coils control).
   Two heating sequences and one cooling sequence are available. For each sequence define the control probe, the setpoint and the PID control parameters. (See "6.2] Heat and cool control sequences").
3. In case of dampers or energy recovery define their control probe, setpoint and changeover conditions. (See "6.1] Damper control sequences").
4. Humidity control
   Define the control probe, setpoint and the way dehumidification is performed. (See "11] Humidity control").
5. Supply limits
   Define the humidity and temperature supply limits which should not be exceeded. (See "10] Controlling the supply temperature limits" and "11.4] Controlling the supply humidity limits").
6. Fans control
   Define the control type, the control probe and if necessary the PID control parameters. (See "12] Supply and return fans").

3.2| *Input/Output configuration*

Below is a complete list of the functions available; these functions can be assigned independently for each input/output.

ANALOG INPUTS		
Code (LED and LCD)	**Description (LCD)**	**Function**
SUP	Supply Temp	Supply air temperature
REt	Return Temp	Return air temperature
OUt	Outside Temp	Outside air temperature
tH1	Preheat Temp	Pre-heating temperature
tH2	Reheat Temp	Re-heating temperature
tC1	Cooling Temp	Cooling temperature
tC2	AntiFreeze	Antifreeze temperature
bAR	Air Pressure	Air pressure
SHU	Sup. Humidity	Supply air humidity
RHU	Ret. Humidity	Return air humidity
CO2	CO2	Air carbon dioxide (CO2) measurement
VOC	VOC	Air volatile organic compounds (VOC) measurement

Tab 6 _ [Configuring the AHU software - Analog Inputs]

DIGITAL INPUTS		
Code (LED and LCD)	**Description (LCD)**	**Function**
ASF	SupFan Alarm	Supply Fan alarm
SSS	SupFan SafeSW	Supply Fan safety switch (port open)
ASR	RetFan Alarm	Return Fan alarm
CSR	MixDamp Closed	Mixing Damper closed
SSR	RetFan SafeSW	Return Fan safety switch
CSE	ExtDamp Closed	External Damper closed
ONF	ON/OFF	Remote ON/OFF
AFI	Fire Alarm	Fire alarm
AAI	Freeze Alarm	Freeze alarm
CH	Summer/Winter	Summer/Winter selection
SFW	Supply Flow	Supply flow alarm
RFW	Return Flow	Return flow alarm
SFI	Supply Filter	Supply air filter plugged
RFI	Return Filter	Return air filter plugged
PU1	Coil1 Pump	Coil 1 pump alarm
PU2	Coil2 Pump	Coil 2 pump alarm
PU3	Coil3 Pump	Coil 3 pump alarm
HUM	HumidifierAlarm	Humidifier alarm
REC	RecoveryAlarm	Energy recovery alarm
GEN	Generic Alarm	Generic alarm
bA1	Coil1 Alarm	Coil 1 alarm
bA2	Coil2 Alarm	Coil 2 alarm
bA3	Coil3 Alarm	Coil 3 alarm
LOF	Lock Fan	Lock/Unlock fans
COE	Comf/Eco	Comfort/Economy selection
FDI	FreeHeatCool	Freeheat/Freecool changeover

Tab 7 _ [Configuring the AHU software - Digital Inputs]

ANALOG OUTPUTS		
Code (LED and LCD)	**Description (LCD)**	**Function**
SUF	Supply Fan	Supply Fan control
REF	Return Fan	Return Fan control
RDA	Mixing damper	Mixing damper control
EDA	External Damper	External damper control
HUA	Humidifier	Humidifier control
bA1	Valve1	Valve 1 control
bA2	Valve2	Valve 2 control
bA3	Valve3	Valve 3 control
DHU	Dehumidifier	Dehumidifier control
ERA	Recovery	Energy recovery control

Tab 8_ [Configuring the AHU software - Analog Outputs]

DIGITAL OUTPUTS		
Code (LED and LCD)	**Description (LCD)**	**Function**
ALA	Alarm	Alarm
WAR	Warning	Warning
SUF	Supply Fan	Supply Fan control
REF	Return Fan	Return Fan control
RDD	Mixing Damper	Mixing Damper control
EDD	External Damper	External Damper control
SFL	SupplyFanLow	Low Supply Fan speed
SFH	SupplyFanHigh	High Supply Fan speed
RFL	ReturnFanLow	Low Return Fan speed
RFH	ReturnFanHigh	High Return Fan speed
dEU	Dehumidifier	External dehumidifier control
HUM	Humidifier	External humidifier control
HUP	HumidPump	Humidifier pump control
ERD	Recovery	Energy recovery control
ERP	Recovery Pump	Energy recovery pump control
b1	Valve1ONOFF	Controls the ON/OFF valve of coil 1
b1O	Valve1Open	Controls opening of 3-point valve of coil 1
b1C	Valve1Close	Controls closing of 3-point valve of coil 1
b11	Coil1Step1	Controls step 1 of coil 1
b12	Coil1Step2	Controls step 2 of coil 1
b13	Coil1Step3	Controls step 3 of coil 1
CP1	Coil1Pump	Coil1 pump control
b2	Valve2ONOFF	Controls the ON/OFF valve of coil 2
b2O	Valve2Open	Controls opening of 3-point valve of coil 2
b2C	Valve2Close	Controls closing of 3-point valve of coil 2
b21	Coil2Step1	Controls step 1 of coil 2
b22	Coil2Step2	Controls step 2 of coil 2
b23	Coil2Step3	Controls step 3 of coil 2
CP2	Coil2Pump	Coil2 pump control
b3	Valve3ONOFF	Controls the ON/OFF valve of coil 3
b3O	Valve3Open	Controls opening of 3-point valve of coil 3
b3C	Valve3Close	Controls closing of 3-point valve of coil 3

DIGITAL OUTPUTS		
Code (LED and LCD)	**Description (LCD)**	**Function**
b31	Coil3Step1	Controls step 1 of coil 3
b32	Coil3Step2	Controls step 2 of coil 3
b33	Coil3Step3	Controls step 3 of coil 3
CP3	Coil3Pump	Coil3 pump control
dEF	Defrost	Defrost activation
HRE	HeatRequest	Request of heating
CRE	CoolRequest	Request of cooling

Tab 9_ [Configuring the AHU software - Digital Outputs]

4| Coils control

4.1| Assign a control sequence to a coil

There are maximum 3 heating and/or cooling coils composing the AHU.

For each of them it is possible to define its function through the following parameters.

ASSIGN A CONTROL SEQUENCE TO A COIL								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b10	Coil 1 function	1	6	HS1		OFF;HS1;HS2;CS1;H1C1;H2C1
	CL2		Coil 2					
		b40	Coil 2 function	1	6	HS2		OFF;HS1;HS2;CS1;H1C1;H2C1
	CL3		Coil 3					
		b70	Coil 3 function	1	6	CS1		OFF;HS1;HS2;CS1;H1C1;H2C1

Tab 10_ [Coils control - Assign a control sequence to a coil]

Possible values are:

- OFF. Coil not used
- HS1. Heating coil controlled with Heat Sequence 1
- HS2. Heating coil controlled with Heat Sequence 2
- CS1. Cooling coil controlled with Cool Sequence 1
- H1C1. Unique coil for heating or cooling, depending on winter/summer selection. Heating is controlled with Heat Sequence 1 and cooling with Cool Sequence 1
- H2C1. Unique coil for heating or cooling, depending on winter/summer selection. Heating is controlled with Heat Sequence 2 and cooling with Cool Sequence 1

As described in detail in "6.2| Heat and cool control sequences", coils are controlled with heating and cooling control sequences according to the following figure.

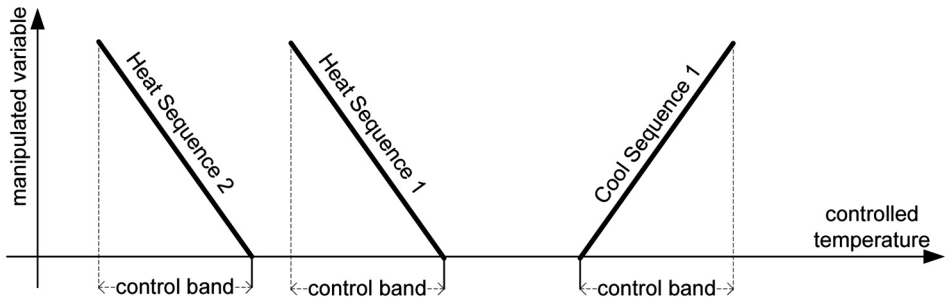

Fig 5 _ [Coils control - Heat and cool sequeces for coil]

It is possible to configure more coils controlled with the same control sequence. In this case they share equally the control band.

Example

** Three coils for heating controlled with Heat Sequence 1; b10=b40=b70=HS1*

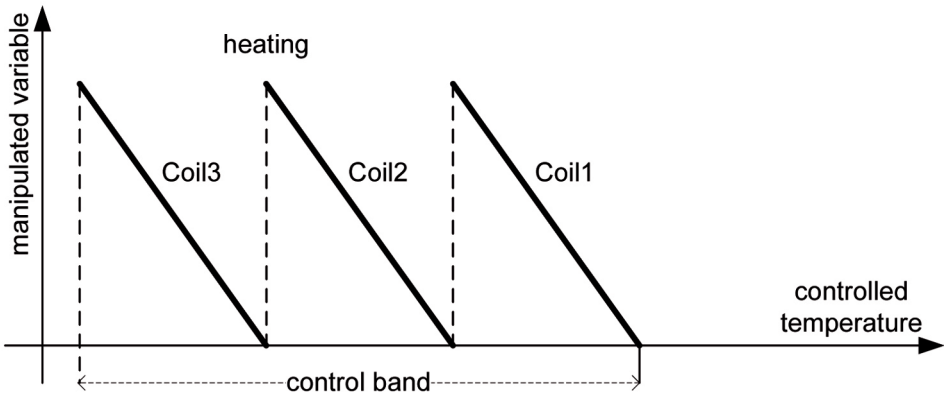

Fig 6 _ [Coils control - example heat sequence]

4.2| *Coil output management*

The following parameters set the way coil output are managed according to the load demand calculated by the associated temperature control sequences (see "6.2] Heat and cool control sequences").

COIL OUTPUT MANAGEMENT								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b11	Actuator 1 type	1	4	VALVE		VALVE;LIN STEP;VAR STEP;BIN STEP
	CL2		Coil 2					
		b41	Actuator 2 type	1	4	LIN STEP		VALVE;LIN STEP;VAR STEP;BIN STEP
	CL3		Coil 3					
		b71	Actuator 3 type	1	4	LIN STEP		VALVE;LIN STEP;VAR STEP;BIN STEP

Tab 10_ [Coils control -Coil output management]

Through b11, b41, b71 you can define the actuator type for each coil, whether it is a water coil controlled trough a valve or it is a step controlled coil (e.g. electric resistances). In this case there are 3 possible way of control: linear step switch, variable step switch binary step switch.

4.3| *Valve control*

If b11, b41, b71 = VALVE, coil is a water coil controlled through a valve. The valve can be ON/OFF, 0/10V modulating or 3 points valve. Depending on the type of valve to be operated, the following outputs are used:

VALVE CONTROL				
Coil	**Type of valve**	**Type of output**	**Output used**	
Coil1	ON/OFF	digital output	b1	Valve1ONOFF
	0/10V	analog output	bA1	Coil1
	3-points	digital output	b1O	Valve1Open to open
			b1C	Valve1Close to close
Coil2	ON/OFF	digital output	b2	Valve2ONOFF
	0/10V	analog output	bA2	Coil2
	3-points	digital output	b2O	Valve2Open to open
			b2C	Valve2Close to close
Coil3	ON/OFF	digital output	b3	Valve3ONOFF
	0/10V	analog output	bA3	Coil3
	3-points	digital output	b3O	Valve3Open to open
			b3C	Valve3Close to close

Tab 11_ [Coils control - Valve control]

Note

**If one of the above output is present, then it is automatically driven by the software, without the need of enabling it.*

4.3.1| *ON/OFF and 0/10V valve control*

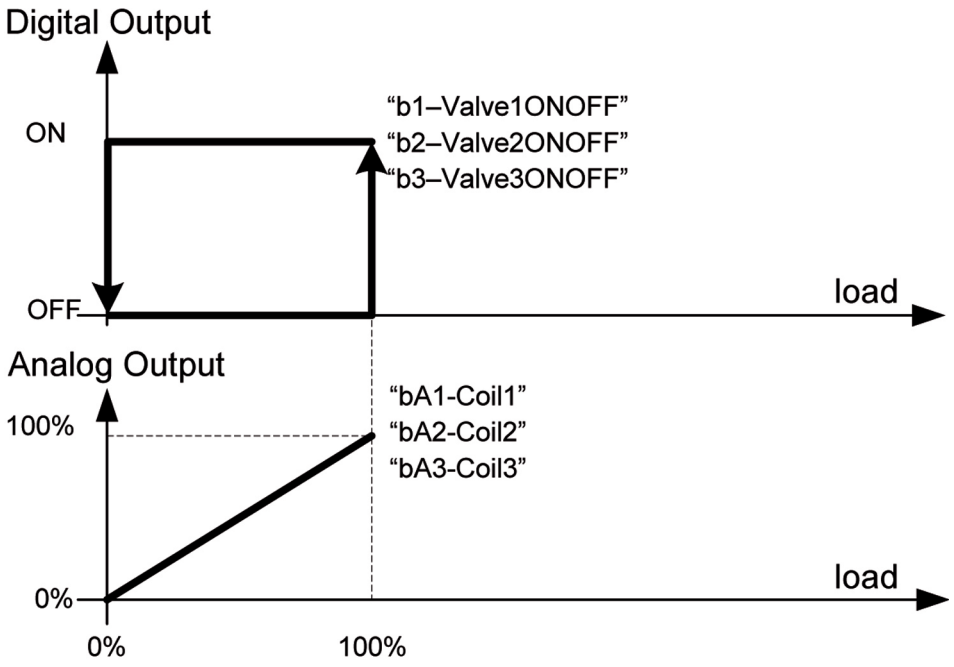

Fig 7 _ [Coils control - ON/OFF and 0/10V valve control]

4.3.2| 3-point valve control

This is a valve with 3 electrical contacts plus the power supply: common, open and close.

The following parameters are used to configure a 3 point valve.

3-POINT VALVE CONTROL								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b13	Valve full excursion time	0	9999	20	SEC	
		b14	Valve minimum variation	0	50	2	%	
		b15	Valve forcing period	0	9999	60	MIN	
		b16	Valve range	0	50	0	%	
	CL2		Coil 2					
		b43	Valve full excursion time	0	9999	20	SEC	
		b44	Valve minimum variation	0	50	2	%	
		b45	Valve forcing period	0	9999	60	MIN	
		b46	Valve range	0	50	0	%	
	CL3		Coil 3					
		b73	Valve full excursion time	0	9999	20	SEC	
		b74	Valve minimum variation	0	50	2	%	
		b75	Valve forcing period	0	9999	60	MIN	
		b76	Valve range	0	50	0	%	

Tab 12_ [Coils control - 3-Point valve control]

b13, b43, b73 – Valve full excursion time

Indicates the time the valve takes to go from fully closed to fully open. The valve control algorithm uses this time to calculate the activation time for the outputs "Valve1-2-3 Open" and "Valve1-2-3 Close".

Depending on the length of time the contact is activated, the extent to which the valve is opened varies from 0% to 100% of the excursion time. The relays are never activated simultaneously, thus the valves either open, or close, or remain still

To obviate the lack of feedback that provides exact information on the valve opening step, the following rules apply:

- When the instrument is turned on, the valve is closed or open all the way for an amount of time equal to the excursion time + 25%, and the position of the valve is realigned before regulation is started.
- Whenever the temperature regulation requires opening or closing a valve all the way, the program increases the opening or closing relay activation time by 25% to ensure that the valve opens or closes all the way.

b14, b44, b74 – Valve minimum variation

This is the minimum shift performed with the valve.

b15, b45, b75 - Valve forcing period

If the valve is fully open or fully closed, the opening or closing command is periodically sent for a time equal to 25% of the full excursion time. The frequency of this command is defined in this parameter.

b16, b46, b76 – Valve range

If the valve is commanded to a position lower than this parameter (as a percentage of the fully open or fully closed position), the valve will open or close all the way.

**b15=5% means that a request for a 4% position will cause the valve to fully close and a request for 96% will cause it to open all the way.*

4.4| Step control

If b11, b41, b71 = LIN STEP or VAR STEP or BIN STEP, coil is step controlled.

To activate the steps (e.g. electric resistances or rows), use the following outputs:

STEP CONTROL			
Coil	**Type of output**	**Output used**	
Coil1	digital output	b11	Coil1Step1
		b12	Coil1Step2
		b13	Coil1Step3
	analog output	bA1	Coil1
Coil2	digital output	b21	Coil2Step1
		b22	Coil2Step2
		b23	Coil2Step3
	analog output	bA2	Coil2
Coil3	digital output	b31	Coil3Step1
		b32	Coil3Step2
		b33	Coil3Step3
	analog output	bA3	Coil3

Tab 13_ [Coils control - Step control]

4.4.1| Linear step switch

If b11, b41, b71 = LIN STEP, coil is step controlled in a linear way.

When linear step switch is selected, you have to set the number of steps, 1..3, for each coil

LINEAR STEP SWITCH								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b12	Number of steps	0	3	2		
	CL2		Coil 2					
		b42	Number of steps	0	3	2		
	CL3		Coil 3					
		b72	Number of steps	0	3	2		

Tab 14_ [Coils control - Linear step switch]

Linear step control is described in the following figure in case of 2 steps. Up to 3 steps are managed.

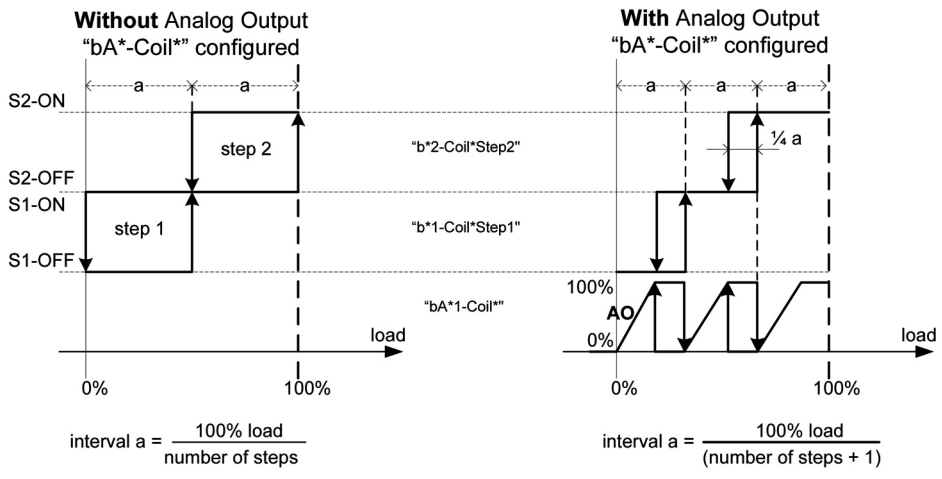

Fig 8 _ [Coils control - Linear step control]

4.4.2| *Variable step switch*

If b11, b41, b71 = VAR STEP, coil is step controlled in a variable way.

When variable step switch is selected, you have to set the number of steps (1..3) for each coil and for each step (of each coil) the ON and OFF switching point in % of the load demand

VARIABILE STEP SWITCH								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b12	Number of steps	0	3	2		
		b17	Step 1 ON	0	1000	10,0	%	
		b18	Step 1 OFF	0	1000	20,0	%	
		b19	Step 2 ON	0	1000	40,0	%	
		b20	Step 2 OFF	0	1000	30,0	%	
		b21	Step 3 ON	0	1000	50,0	%	
		b22	Step 3 OFF	0	1000	100,0	%	
	CL2		Coil 2					
		b42	Number of steps	0	3	2		
		b47	Step 1 ON	0	1000	10,0	%	
		b48	Step 1 OFF	0	1000	0,0	%	
		b49	Step 2 ON	0	1000	10,0	%	
		b50	Step 2 OFF	0	1000	30,0	%	
		b51	Step 3 ON	0	1000	50,0	%	
		b52	Step 3 OFF	0	1000	33,0	%	
	CL3		Coil 3					
		b72	Number of steps	0	3	2		
		b77	Step 1 ON	0	1000	17,0	%	
		b78	Step 1 OFF	0	1000	0,0	%	
		b79	Step 2 ON	0	1000	33,0	%	
		b80	Step 2 OFF	0	1000	17,0	%	
		b81	Step 3 ON	0	1000	50,0	%	
		b82	Step 3 OFF	0	1000	33,0	%	

Tab 15_ [Coils control - Variable step switch]

Variable step control is described in the following figure in case of 2 steps. Up to 3 steps are managed.

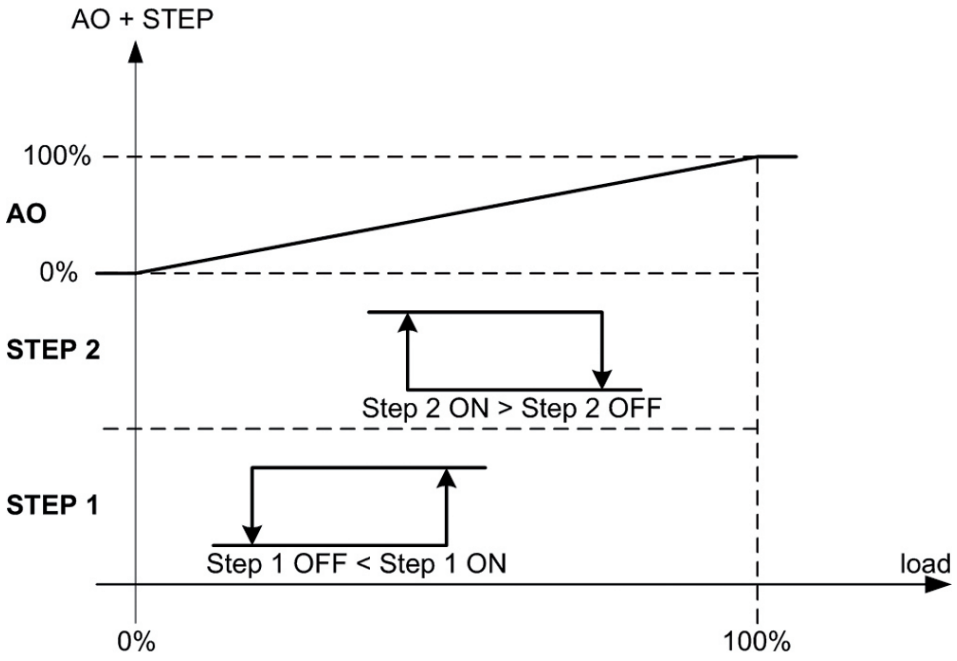

Fig 9 _ [Coils control - Variabile step control]

4.4.3| Binary step switch

If b11, b41, b71 = LIN STEP, coil is step controlled in a binary way.

When binary step switch is selected, you have to set the number of steps, 1..3, for each coil

BINARY STEP SWITCH								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b12	Number of steps	0	3	2		
	CL2		Coil 2					
		b42	Number of steps	0	3	2		
	CL3		Coil 3					
		b72	Number of steps	0	3	2		

Tab 16_ [Coils control - Binary step switch]

Binary Step control is described in the following figure in case of 2 steps. Up to 3 steps are managed.

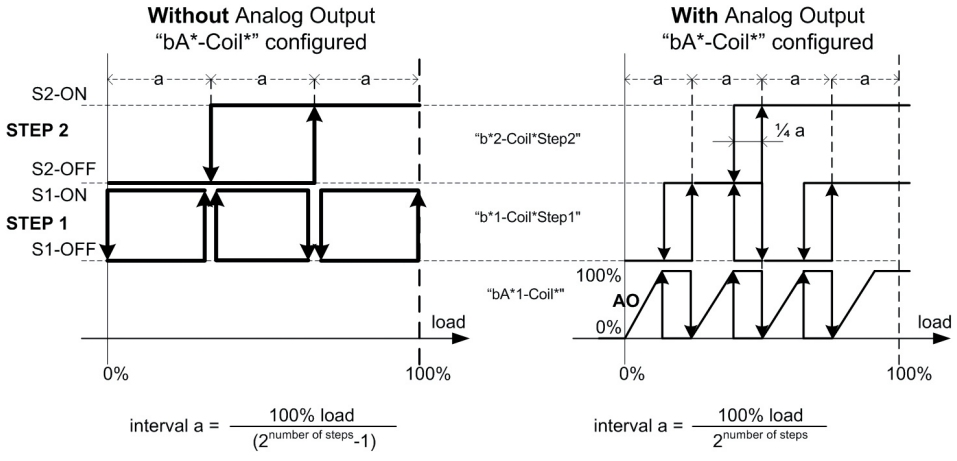

Fig 10 _ [Coils control - Bianry step control]

4.5| Locking sequences

For each coil it is possible to lock the cooling or heating control if the outside temperature measured with the "OUT – Outside Temp" probe goes beyond the following limits.

LOCKING SEQUENCES								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CL1		Coil 1					
		b29	Cooling lock	-40,0	100,0	-30,0	°C	
		b30	Heating lock	-40,0	100,0	90,0	°C	
	CL2		Coil 2					
		b59	Cooling lock	-40,0	100,0	-30,0	°C	
		b60	Heating lock	-40,0	100,0	90,0	°C	
	CL3		Coil 3					
		b89	Cooling lock	-40,0	100,0	-30,0	°C	
		b90	Heating lock	-40,0	100,0	90,0	°C	

Tab 17_ [Coils control - Locking sequences]

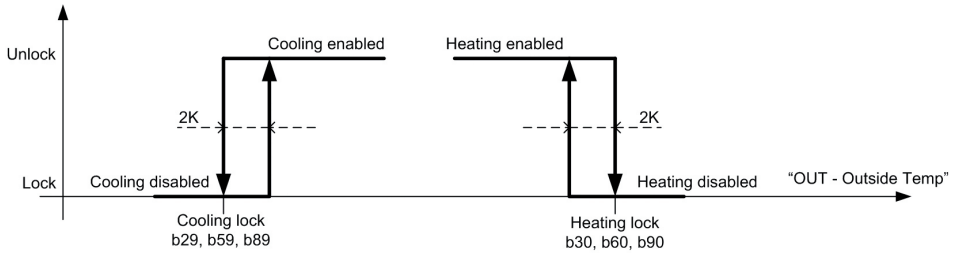

Fig 11 _ [Coils control - Locking sequences]

4.6| *Pumps control*

Is possible to managed one pump for each coil through the following digital output:

PUMPS DIGITAL OUTPUT			
Coil	**Type of output**	**Output used**	
Coil1	digital output	CP1	Coil1Pump
Coil2	digital output	CP2	Coil2Pump
Coil3	digital output	CP3	Coil3Pump

Tab 18_ [Coils control - Pumps digital output]

If present, the pumps are activated when request is sent to the corresponding coil. You can define the load percentage to switch on the pump, via PON parameter, and to switch it OFF, via POF parameter.

Example

**Pump switches ON at 5% and OFF at 0%.*

You can also define a switch OFF delay POd for the pumps.

PUMPS CONTROL								
PUM			**Pumps**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	STU		Setup					
		POd	Pump delay at OFF	0	9999	5	SEC	
		PON	Power request activation	0	9999	5,0	%	
		POF	Power request deactivation	0	9999	0,0	%	
		PFr	Outside temperature ON	-50,0	10,0	-20,0	°C	

Tab 19_ [Coils control - Pumps control]

4.6.1| Pumps winter start

All the configured pumps will be operated if the outside temperature goes below a fixed limit PFr to prevent freezing. The "ice" blinking icon signals this function.

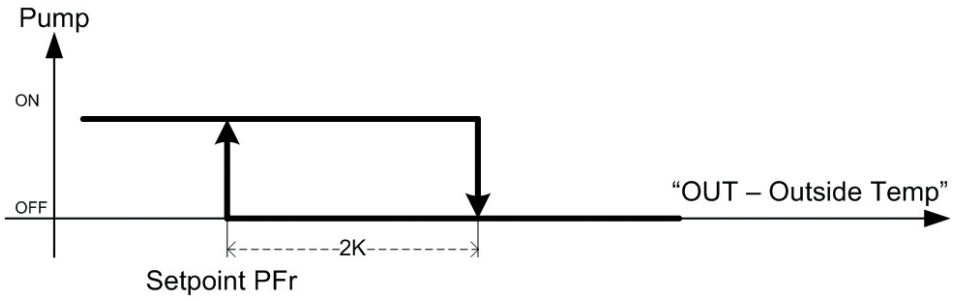

Fig 12 _ [Coils control - Pumps winter start]

(See "9] Frost protection" for further actions to prevent frost.)

4.7| Single Heat/Cool coils

In case of unique coil for heating and cooling (b10, b40, b70 = H1C1 or H2C1), the selection between the 2 possible modes is as follows.

SINGLE HEAT/COOL COILS								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	HCC		HeatCool Coil					
		HC1	Winter/Summer probe selection	1	5	OUt		NO;SUP;REt;tH1;OUt
		HC2	Setpoint	-15,0	90,0	14,0	°C	
		HC3	Hysteresis	0,1	90,0	12,0	K	

Tab 20_ [Coils control - Single Heat/Cool coils]

- » From the digital input "CH - Summer/Winter", if present. With input polarity = "N.O.", when the input is open the summer mode is selected and thus coil is used for cooling;
- » from the "Utilities" menu (see "2.4.5| Utilities");
- » from a comparison between the probe defined in HC1 and the setpoint HC2 (see figure). When this mode is enabled (HC1 other than 0) it has priority over all the others.

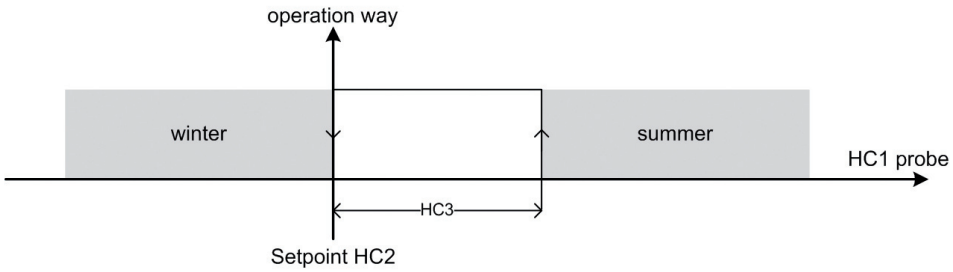

Fig 13 _ [Coils control - Comparison between probe HC1 and Setpoint HC2]

Note

**Summer/Winter selection has influence over the way of controlling fans. (See "12.1 Type of supply and return fans").*

4.8| Cooling coil defrost control

COOLING COIL DEFROST CONTROL								
COI			**Coils**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	dEF		Defrost					
		dE1	Probe selection	1	8	REt		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		dE2	Setpoint	-15,0	90,0	5,0	°C	
		dE3	Hysteresis	0,1	20,0	2,0	K	

Tab 21_ [Coils control - Cooling coil defrost control]

If enabled (dE1 other than 0), the control is performed according to the value read on the probe selected with dE1, and comparing the reading to setpoint dE2 and hysteresis dE3

If the temperature is lower than the setpoint, a defrost output "DEF - Defrost" is activated. It is disabled when the value is above the setpoint + hysteresis.

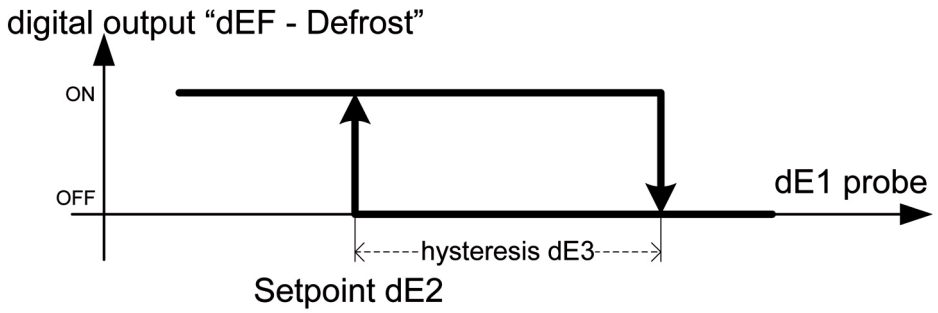

Fig 14_ [Coils control - Digital output Defrost]

4.9| Heat/Cool request

Is possible to managed two output signaling heat and cool request.

HEAT/COOL REQUEST		
Type of output	**Output used**	
digital output	HRE	HeatRequest
	CRE	CoolRequest

Tab 22_ [Coils control - Heat/Cool request]

"**HRE – HeatRequest**" is ON when the load demand from Heat Sequence 1 or 2 is greater than 0.

"**HCE – CoolRequest**" is ON when the load demand from Cool Sequence 1 is greater than 0.

5| Dampers and Energy recovery control

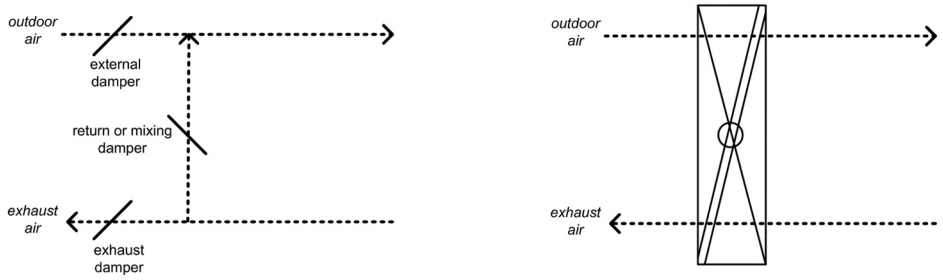

Fig 15 _ [Dampers and Energy recovery control - Dampers and Energy recovery control]

Dampers and Energy recovery unit are both controlled with the same control sequence, called "Damper Sequence" (see "6.1] Damper control sequences").

5.1| External and Mixing dampers

The external damper load demand (Pext) is calculated by the damper sequence (see "6.1] Damper control sequences").

The mixing damper load demand (Pmix) is calculated as antagonistic to the external damper. Pmix=100-Pext.

External and mixing dampers can be ON/OFF or modulating. If they are not mechanically linked, a separated output for each damper is available.

Depending on the type of damper to be operated, the following outputs are used.

EXTERNAL AND MIXING DAMPERS			
Type of damper	**Type of output**	**Output used**	
ON/OFF	digital output	RDD	Mixing Damper
		EDD	External Damper
0/10V	analog output	RDA	Mixing Damper
		EDA	External Damper

Tab 23_ [Dampers and Energy recovery control - External and Mixing dampers]

5.1.1| ON/OFF dampers

If dampers are of the ON/OFF type, they are controlled by the digital outputs "RDD - Mixing Damper" and "EDD - External Damper".

Since their operation is mutually antagonistic, opening one closes the other. Opening occurs when the demand is for more than 50%. When both require 50%, the mixing damper opens.

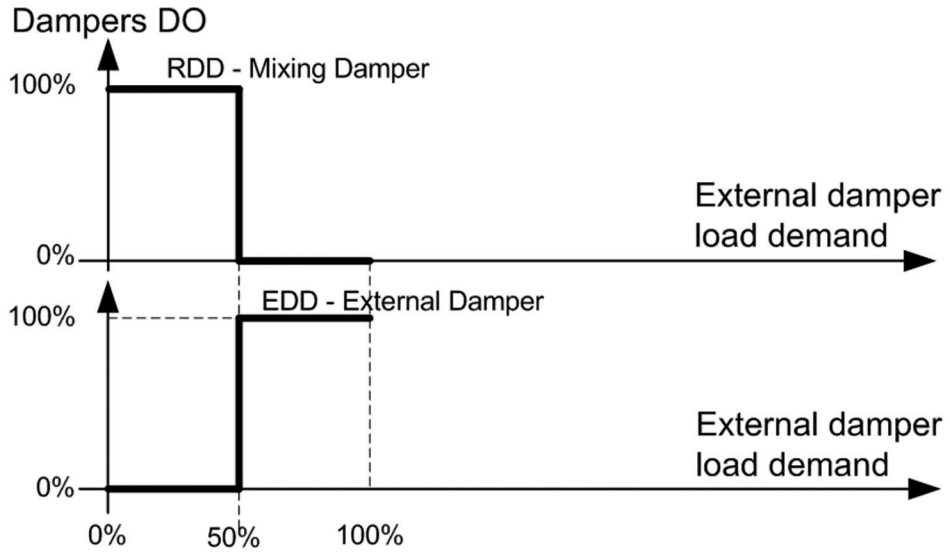

Fig 16 _ [Dampers and Energy recovery control - ON/OFF dampers]

5.1.2| 0/10V dampers

If dampers are of the modulating type, they are controlled by the analog outputs "RDA - Mixing Damper" and "EDA - External Damper".

Since their operation is mutually antagonistic, if the external damper is opened to 25%, the mixing damper will be opened to 75%, as described in the following figure.

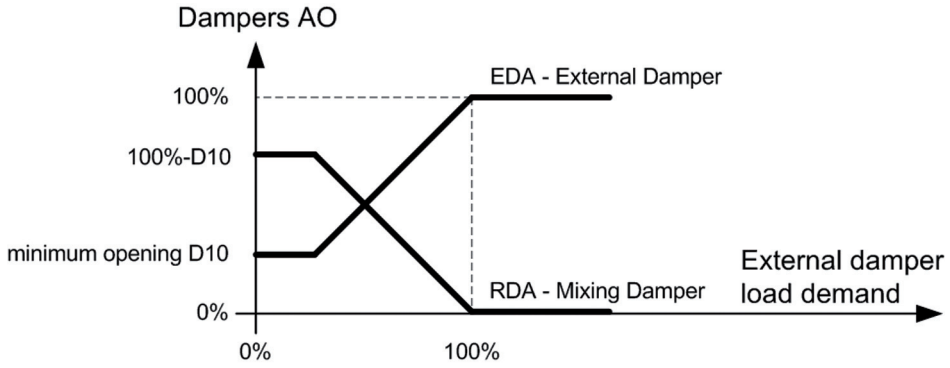

Fig 17 _ [Dampers and Energy recovery control - 0/10V dampers]

5.1.3| Damper locked

The external damper locked alarm A02 and mixing damper locked alarm A05 indicates that the digital input used to monitor damper opening "CSE - ExtDamp Closed" and "CSR - MixDamp Closed signals that the damper is closed and, at the same time, the damper control is active for at least 3 seconds.

5.2| Energy recovery

The energy recovery load demand is calculated by the damper sequence as it is for the mixing damper (see "6.1] Damper control sequences").

It is possible to manage the following output as described in figure.

ENERGY RECOVERY		
Type of output	**Output used**	
digital output	ERD	Recovery
	ERP	Recovery Pump
analog output	ERA	Recovery

Tab 24_ [Dampers and Energy recovery control - Energy recovery]

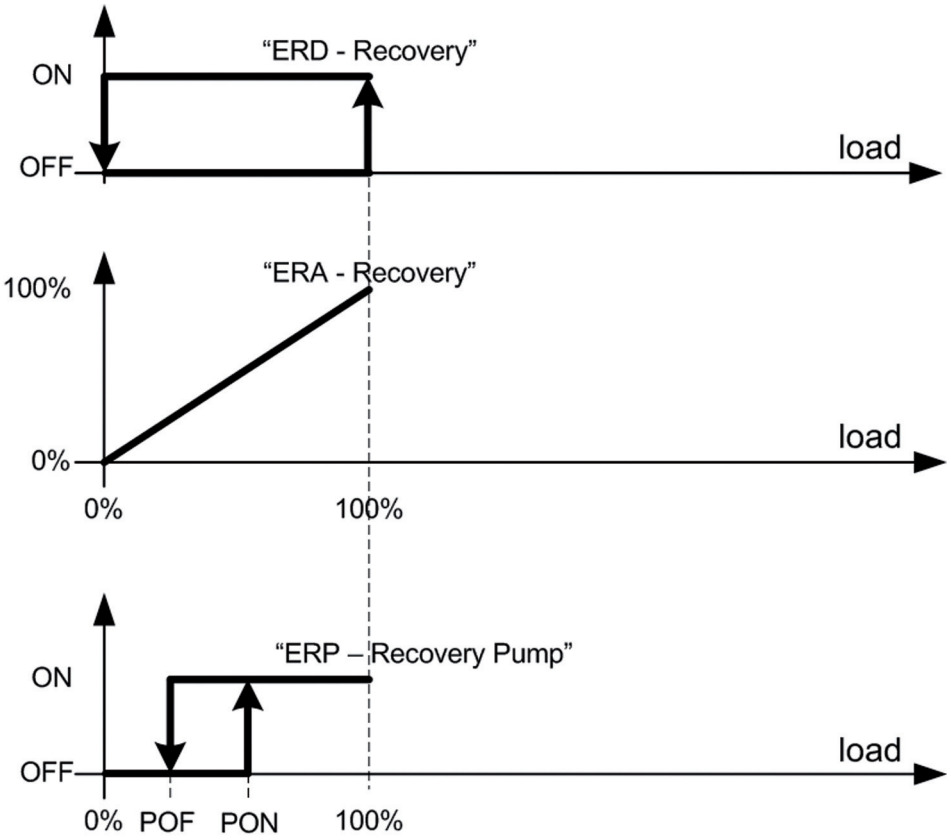

Fig 18 _ [Dampers and Energy recovery control - Energy recovery]

(See "4.6] Pumps control") for how to control the recovery pump.

6| Temperature control sequences

To control temperature are managed some control sequences. One is dedicated to dampers; the others are 2 for heating and one for cooling process and must be assigned to the desired coil.

6.1| Damper control sequences

There is one control sequences dedicated to dampers which is able to manage the external damper, mixing damper and energy recovery.

The mixing damper and the energy recovery are antagonistic to the external damper.

Hereafter we refer mainly to the external damper.

The control sequence is configured using the following parameters:

DAMPER CONTROL SEQUENCES								
TCT			**Temp Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	DAP		Damper Sequence					
		D01	Control probe	1	8	4		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		D02	Freecool setpoint selection	1	4	1		MAIN;CASC;LS1;LS2;FRH
		D03	Freeheat setpoint selection	1	4	1		MAIN;CASC;LS1;LS2
		D04	Freecool offset	-20,0	20,0	0,0	K	
		D05	Freeheat offset	-20,0	20,0	0,0	K	
		D06	Proportional band	0,1	20,0	10,0	K	
		D07	Changeover probe 1	1	9	OUT		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2;DI
		D08	Changeover probe 2	2	9	REt		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2;SET
		D09	Offset changeover (MECHSET)	0,1	20,0	1,0	K	
		D10	Minimum opening	0	100	15	%	

Tab 25_ [Temperature control sequences - Damper control sequences]

You have to define

D01: the control probe.

D02: the setpoint used for freecooling, when freecooling is possible (see "6.1.1] Freecooling/Freeheating selection"). Possible values are:

- **MAIN**: main setpoint ATS (STH for heating and STC for cooling, eventually compensated), (see "6.4] Main setpoint");
- **CASC**: supply temperature setpoint coming from the cascade controller (see "7] Cascade Control");
- **LS1**: local setpoint LS1, (see "6.5] Local setpoint");
- **LS2**: local setpoint LS2, (see "6.5] Local setpoint");
- **FRH**: connected to the setpoint of the freeheating sequence (only for freecooling sequence). (see "6.3] Connection of setpoint sequences").

D03: the setpoint used for freeheating, when freeheating is possible (see "6.1.1 Freecooling/Freeheating selection"). See above for possible values.

D04: offset of the freecool setpoint.

D05: offset of the freeheat setpoint.

D06: proportional band for the proportional control.

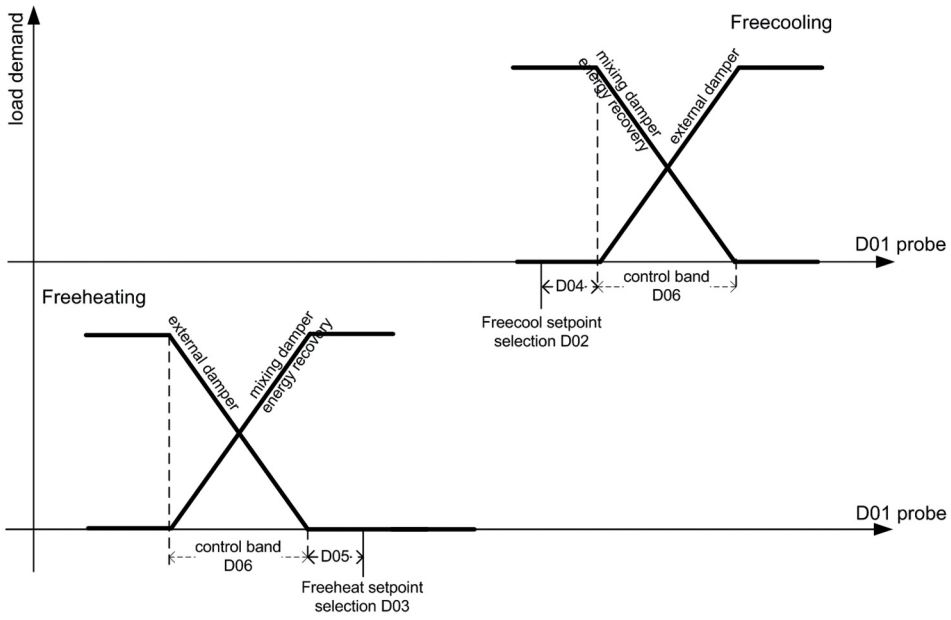

Fig 19_ [Temperature control sequences - Damper control sequences]

Through the offset D04 and D05 you can define the modulation starting point of the damper in freecooling and in freeheating respect to the freecooling and freeheating selected setpoint.

Note

** In the previous figures are displayed positive values of the offset.*

As described in the figure above, there are two possible way of working for the damper, freeheating and freecooling. They are mutually exclusive.

6.1.1| Freecooling/Freeheating selection

The selection between freecooling or freeheating is obtained in the following ways.

1. Assign two probes for the comparison through the parameters D07 and D08.
   If Probe(D07) <= Probe(D08) then freecooling
   If Probe(D07) >= Probe(D08) + D09 then freeheating

2. If D07=DI, through digital input "FDI - FreeHeatCool".

Note

** If, during the input configuration phase, you set "Polarity = N.C", freeheat is selected when the input is open.*

3. If D08=SET, then probe selected with D07 is compared to parameter D09.
   If Probe(D07) <= D09 then freecooling
   If Probe(D07) >= D09 + 2,0 then freeheating

6.1.2| Minimum opening

For granting a minimum amount of fresh air , it is possible to define a minimum opening of the external damper with D10.

6.2| *Heat and cool control sequences*

There are 2 possible heat control sequences, HS1 and HS2, and 1 cool control sequence, CS1, which can be used to control coils (see "4.1] Assign a control sequence to a coil").

Each control sequence is configured using the following parameters:

HEAT AND COOL CONTROL SEQUENCES								
TCT			**Temp Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	HS1		Heat Sequence 1					
		H11	Control probe	1	8	REt		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		H12	Setpoint	1	4	MAIN		MAIN;CASC;LS1;LS2;FRH
		H13	Offset	0,0	10,0	0,0	K	
		H14	Proportional band	0,1	20,0	3,0	K	
		H15	Integral time	0	9999	0	SEC	
		H16	Derivative time	0	9999	0	SEC	
	CS1		Cool Sequence 1					
		C11	Control probe	1	8	REt		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		C12	Setpoint	1	4	MAIN		MAIN;CASC;LS1;LS2;FRC
		C13	Offset	0,0	10,0	0,0	K	
		C14	Proportional band	0,1	20,0	2,0	K	
		C15	Integral time	0	9999	0	SEC	
		C16	Derivative time	0	9999	0	SEC	
	HS2		Heat Sequence 2					
		H21	Control probe	1	8	SUP		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		H22	Setpoint	1	4	LS1		MAIN;CASC;LS1;LS2,FRH;HS1
		H23	Offset	0,0	10,0	0,0	K	
		H24	Proportional band	0,1	20,0	3,0	K	
		H25	Integral time	0	9999	0	SEC	
		H26	Derivative time	0	9999	0	SEC	

Tab 26_ [Temperature control sequences - Heat and cool control sequences]

For each control sequence you have to define respectively:

H11, C01, H21: the control probe.

H12, C02, H21: the setpoint used. Possible values are:

- **MAIN**: main setpoint (STH for heating and STC for cooling, eventually compensated), see "6.4 Main setpoint"
- **CASC**:supply temperature setpoint coming from the cascade controller (see "7 Cascade Control").
- **LS1**: local setpoint LS1, see "6.5 Local setpoint"
- **LS2**: local setpoint LS2, see "6.5 Local setpoint"
- **FRC**: connected to the setpoint of the Freecooling Sequence (only for Cool Sequence 1). See "6.3 Connection of setpoint sequences".
- **FRH**: connected to the setpoint of the Freeheating Sequence (only for Heat Sequence 1). See "6.3 Connection of setpoint sequences".
- **HS1**: connected to the setpoint of the Heat Sequence 1 (only for the Heat Sequence 2). See "6.3 Connection of setpoint sequences".

H13, C03, H23: offset of the used setpoint. See "6.3 Connection of setpoint sequences".

H14, C04, H24: proportional band of the PID control.

H15, C05, H25: integral time of the PID control.

H16, C06, H26: derivative time of the PID control.

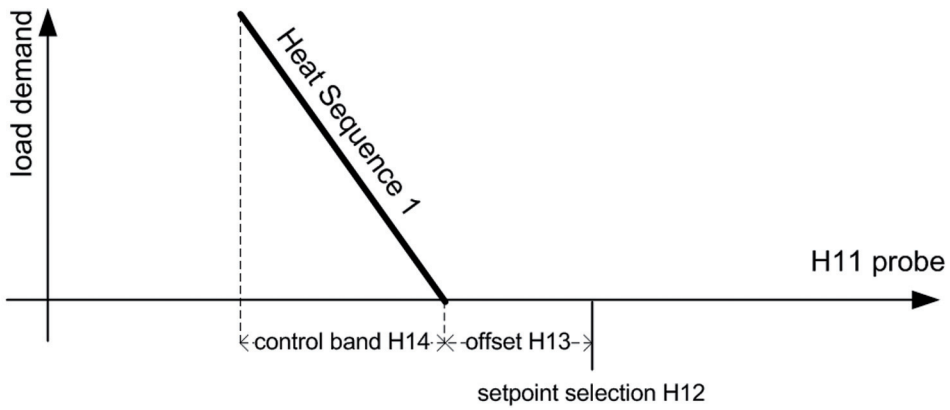

Fig 20_ [Temperature control sequences - Heat sequence 1]

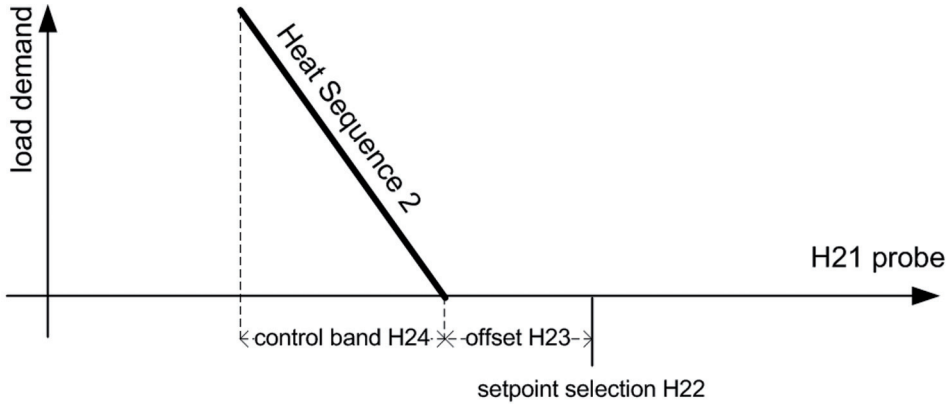

Fig 21_ [Temperature control sequences - Heat sequence 2]

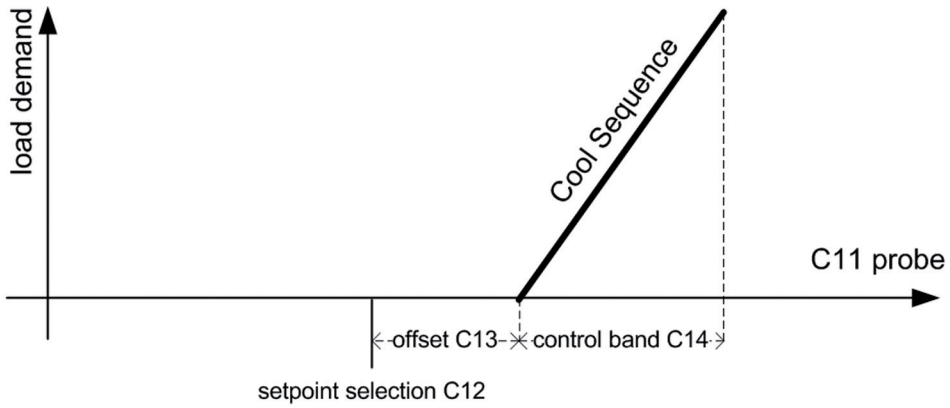

Fig 22_ [Temperature control sequences - Cool sequence]

Note

** the previous figures are displayed positive values of the offset.*

6.3| *Connection of setpoint sequences*

To facilitate interconnections among sequences, it is possible to automatically make one sequence start when the preceding one is at 100% and to make it use automatically the same control probe. The probe used is the one used by the preceding sequence.

When selecting the setpoint for a sequence (D02, H12, H22, C12), set it to the reference of the preceding sequence, using the following values:

FRH: connection to the Freeheat Sequence. Possible for all the sequences.

FRC: connection to the Freecool Sequence. Possible only for Cool Sequence 1.

HS1: connection to the Heat Sequence 1. Possible only for Heat Sequence 2

In the next figure you can see the result of the following settings:
H12=FRH: setpoint of the Heat Sequence 1 connected to Freeheat Sequence
H22=HS1: setpoint of the Heat Sequence 2 connected to Heat Sequence 1
C12=FRC: setpoint of the Cool Sequence 1 connected to Freecool Sequence
The control probe is forced for all the sequences to the one used by dampers.

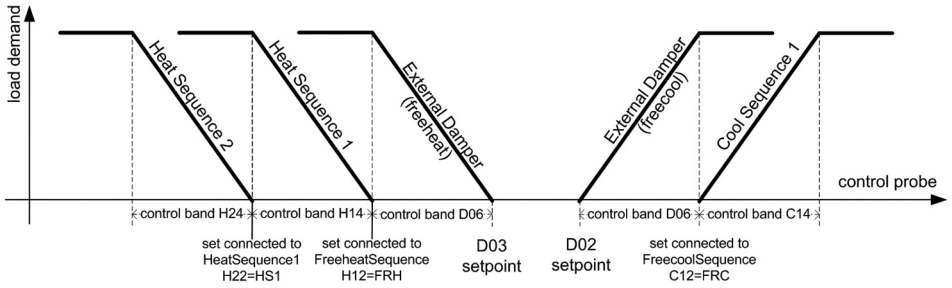

Fig 23_ [Temperature control sequences - Connection of setpoint sequences]

In the next figure you can see the result of setting D02=FRH: setpoint of Freecool Sequence connected to the Freeheat Sequence.

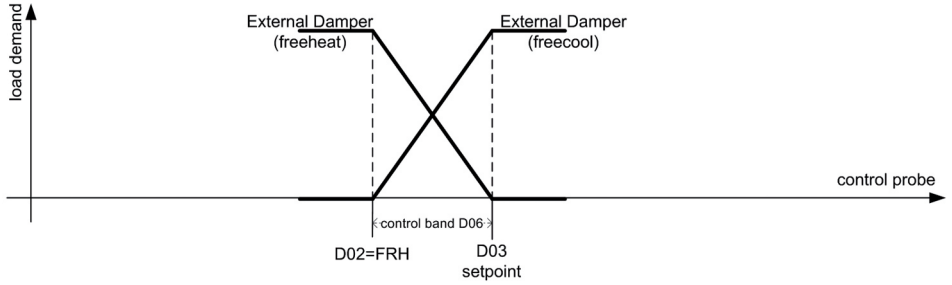

Fig 24_ [Temperature control sequences - Setpoint of Freecool sequence connected to the freeheat Sequence]

6.4| Main setpoint

MAIN SETPOINT								
SET			**Setpoint**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	MST		Main Setpoint					
		STH	Setpoint heat	-15,0	90,0	21,0	°C	
		STC	Setpoint cool	-15,0	90,0	21,0	°C	
		HUM	Min setpoint humidity	0	100,0	40,0	%	
		DEH	Max setpoint humidity	0	100,0	60,0	%	
	EST		Economy Setpoint					
		ES1	Economy set enable	1	2	NO		NO;YES
		ES2	Offset set heat economy	-15,0	90,0	-3,0	°C	
		ES3	Offset set cool economy	-15,0	90,0	2,0	°C	
	COM		TempCompensation					
		TC1	Probe selection	1	8	OUt		NO;SUP;REt;OUt;tH1;tH2;tC1;tC2
		TC2	Winter end temperature	-15,0	90,0	-5,0	°C	
		TC3	Winter start temperature	-15,0	90,0	5,0	°C	
		TC4	Winter offset	-10,0	10,0	-2,0	K	
		TC5	Summer start temperature	-15,0	90,0	31,0	°C	
		TC6	Summer end temperature	-15,0	90,0	38,0	°C	
		TC7	Summer offset	-10,0	10,0	7,0	K	

Tab 26_ [Temperature control sequences - Main setpoint]

The main temperature setpoint are STH for heating and STC for cooling temperature control.
The active temperature setpoint (hereafter ATS) is then:

ATS=STH in heating

ATS=STC in cooling

Through parameters D02, D03, H12, H22, C12, they can be assigned to the specific sequence,
(see "6] Temperature control sequences").

The main humidity setpoint are HUM for humidifying and DEH for dehumidifying control.

Main setpoint are accessible from the user interface in an shorten way, by pressing the DOWN key for 3 seconds.
Main setpoint are affected by economy mode and temperature compensation

6.4.1| Economy mode

The economy mode can be enabled by ES1=YES or via digital input "COE – Comf/Eco".
By enabling the economy mode, the main temperature setpoint are changed by ES2 and ES3 quantity.

The Active Temperature Setpoint (ATS) becomes:

ATS=STH+ES2 in heating

ATS=STC+ES3 in cooling

6.4.2| Temperature compensation

The setpoint can be compensated according to the value of a probe defined with TC1 parameter. If TC1=NO, compensation is not enabled.

The way ATS is related to the TC1 probe values is described in the following figure.

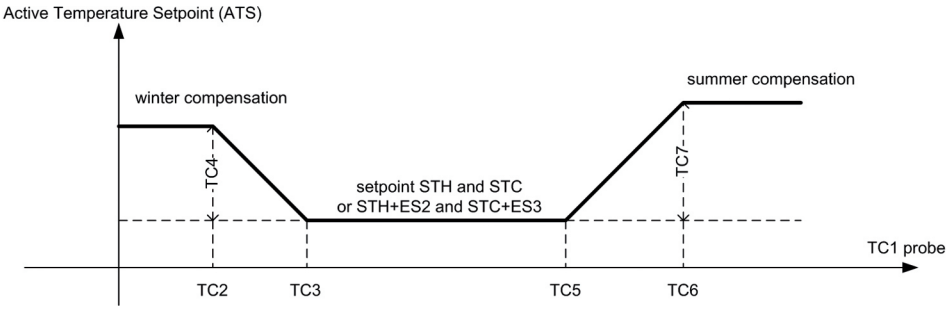

Fig 25_ [Temperature control sequences - Temperature compensation]

Note that the diagram corresponds to positive values of TC4, TC7 and TC2 < TC3 < TC5 < TC6.

Typically the probe used for compensation is the outside probe "OUT – Outside Temp" (TC1=OUT) and then we can talk about summer and winter compensation.

6.5| Local setpoint

LOCAL SETPOINT								
SET			**Setpoint**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	LST		Local Setpoint					
		LS1	Local set1	-15,0	90,0	21,0	°C	
		LS2	Local set2	-15,0	90,0	90,0	°C	

Tab 27_ [Temperature control sequences -Local setpoint]

Is possible to define two "local" setpoint LS1 and LS2 which are not affected by economy mode and compensation and are not accessible from the user interface in a shorten way.

Through parameters D02, D03, H12, H22, C12, they can be assigned to the specific sequence, (see "6] Temperature control sequences").

7| Cascade Control

Cascade Control uses the output of the return temperature controller to manipulate the setpoint of the supply temperature controller.

CASCADE CONTROL								
SCT			**Supply Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CAS		Cascade Control					
		CS1	Proportional component	0,0	100,0	2,0	K	
		CS2	Integral time	0	9999	0	SEC	
		CS3	Min delta supply limit	0	60,0	20,0	K	
		CS4	Max delta supply limit	0	60,0	20,0	K	
	STL		TemperatureLimit					
		TL1	Supply temp low limit	-15,0	90,0	16,0	°C	
		TL2	Supply temp high limit	-15,0	90,0	35,0	°C	

Tab 28_ [Cascade control -Cascade control]

Cascade regulation is used by a sequence when its selected setpoint is "CASCADE". (D02, D03, H12, H22, C12 = CASCADE). In this case it is not possible to select the control probe used by the control sequence, as it is fixed to the return and supply temperature.

Setpoint for supply temperature control is calculated on the basis of the return temperature and main setpoint heat and cool, as described in the following figure, with PI logic and with the following limits:

Return_Temperature – CS3 <= Setpoint_of_supply_Temperature <= Return_Temperature + CS4

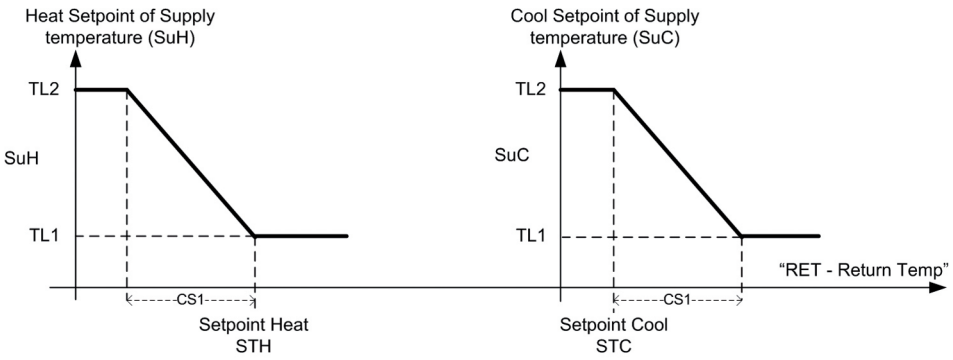

Fig 26_ [Cascade Control - RET Return Temperature]

Calculated setpoint are then used by the control sequence to control the supply temperature.

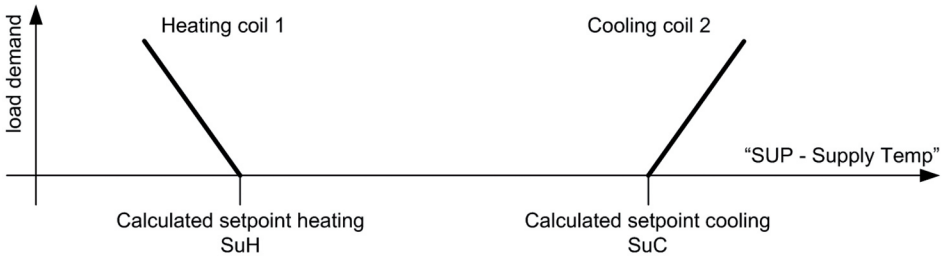

Fig 27_ [Cascade Control - SUP Supply Temperature]

8| Examples

8.1| Example 1

Control of the saturation temperature with preheating coil and dampers.

Return temperature control with cooling ad reheating coil.

Dampers control comparing return and outside temperature

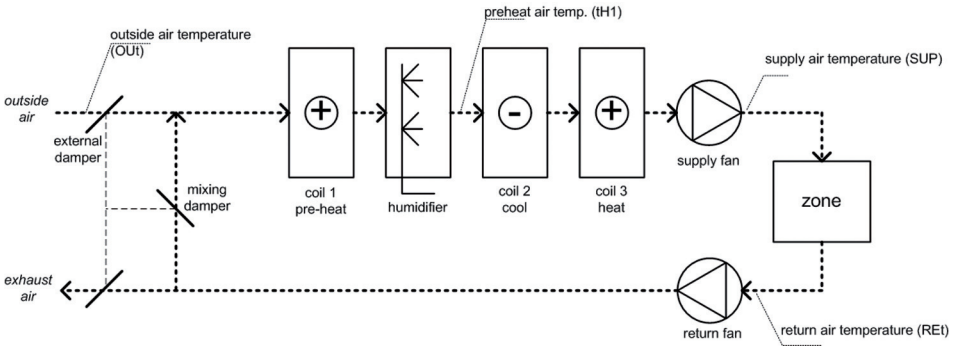

Fig 28_ [Examples - Example 1]

Dampers

D01 – control probe = **tH1** (preheat probe)
D02 – freecool setpoint selection = FRH (connected to the freeheat sequence).
D03 – freeheat setpoint selection = **LS1** (saturation temperature setpoint)
D07 – changeover probe 1 = RET (return probe)
D08 – changeover probe 2 = OUT (outside probe)

Preheating coil

b10 – coil 1 function = HS1 (heat sequence 1)
H11 – control probe = **tH1** (preheat probe)
H12 – setpoint selection = **FRH** (connected to the freeheat sequence)

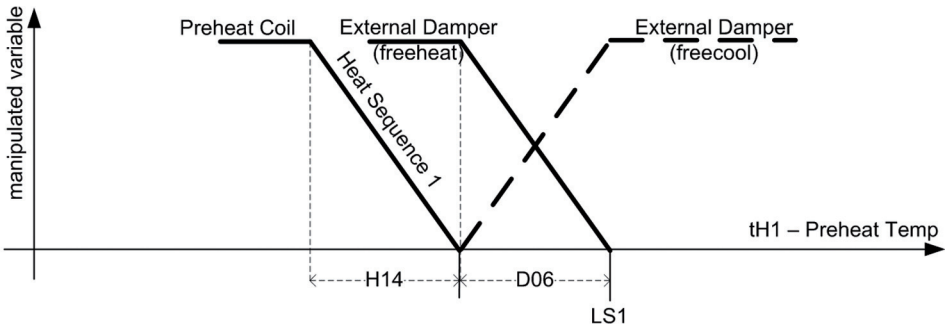

Fig 29_ [Examples - Preheating coil]

Cooling coil

b40 – coil 2 function = CS1 (cool sequence 1)
C11 – control probe = RET
C12 – setpoint selection = MAIN (set cool STC)

Reheating coil

b70 – coil 3 function = HS2 (heat sequence 2)
H21 – control probe = RET
H22 – setpoint selection = MAIN (set heat STH)

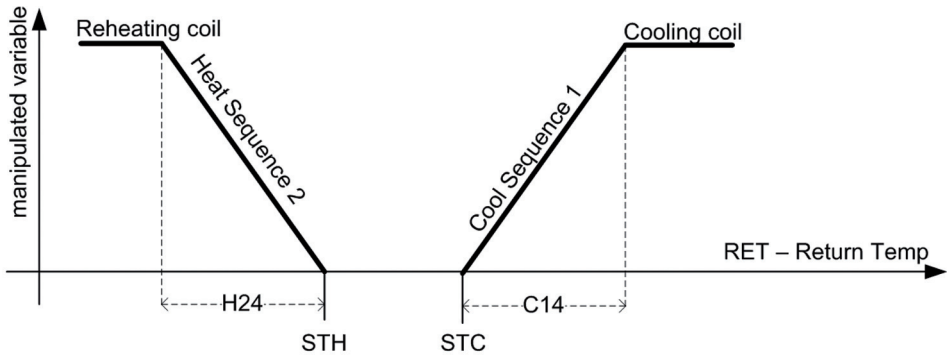

Fig 30_ [Examples - Reheating coil]

8.2| *Example 2*

Control of the return and supply temperature with cascade control through heating coil, cooling coil and dampers. Dampers control comparing return and outside temperature.

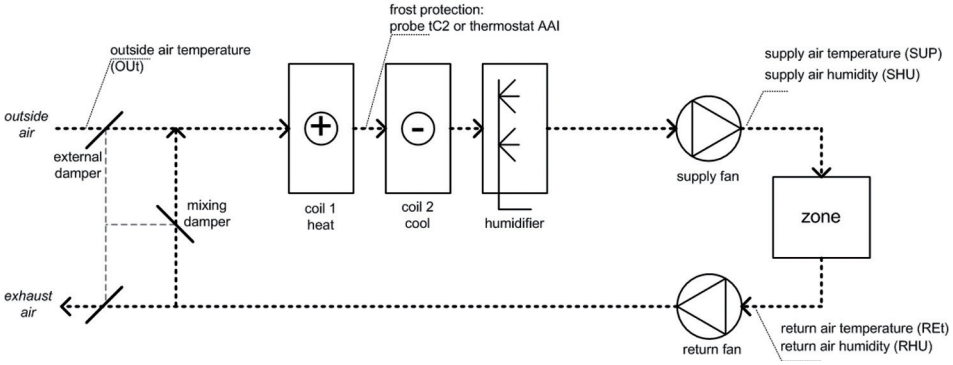

Fig 31_ [Examples - Example 2]

Dampers

D01 – control probe = SUP (room/supply control in CASCADE)
D02 – freecool setpoint selection = CASCADE.
D03 – freeheat setpoint selection = CASCADE
D07 – changeover probe 1 = RET (return probe)
D08 – changeover probe 2 = OUT (outside probe)

Heating coil

b10 – coil 1 function = HS1 (heat sequence 1)
H11 – control probe = SUP (room/supply control in CASCADE)
H12 – setpoint selection = FRH (connected to the freeheat sequence)

Cooling coil

b40 – coil 2 function = CS1 (cool sequence 1)
C11 – control probe = SUP (room/supply control in CASCADE)
C12 – setpoint selection = FRC (connected to the freecool sequence)

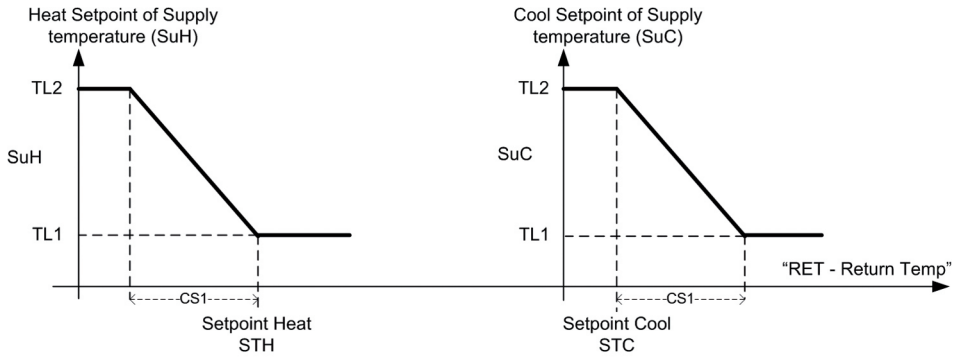

Fig 32_ [Examples - RET Return Temperature]

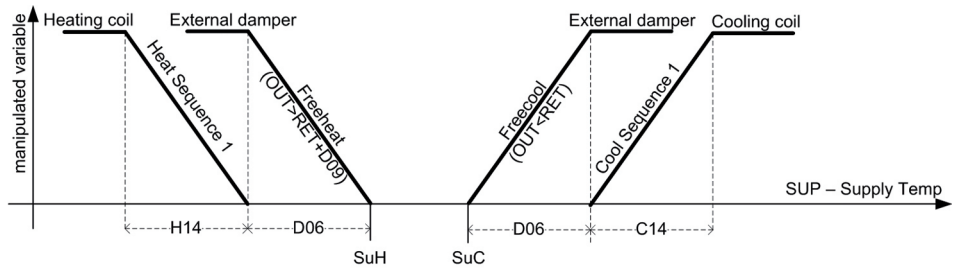

Fig 33_ [Examples - SUP Supply Temperature]

9| *Frost protection*

To enable the frost protection function you have first to define with FP1 the probe used for controlling the temperature.

FROST PROTECTION								
FRO			**Frost**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	FPP		Frost Protection					
		FP1	Probe selection	1	3	OUt		;NO;OUT;tC2
		FP2	Alarm setpoint	5,0	90,0	2,0	°C	
		FP3	Proportional band	0,1	20,0	1,0	K	

Tab 29_ [Frost protection - Frost protection]

When the selected probe temperature is close to the alarm setpoint FP2, the heat actuators are activated proportionally as described in the following figure.

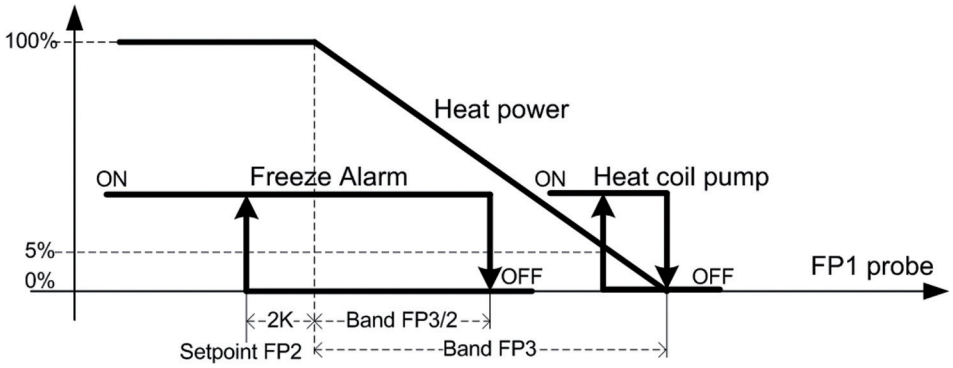

Fig 34_ [Frost protection - Frost Protection]

When the temperature goes below the alarm setpoint FP2, then the "A07 - Freeze Alarm" is generated and heat power is set to 100%, cool power to 0%, the external damper goes to its minimum position and the heat recovery is OFF.

Note

** The "A07 - Freeze Alarm" is generated also by the thermostat (digital input) "AAI - Freeze Alarm". (See "14.3] Alarms table").*

** If the "A07 - Freeze Alarm" is set by Configurator to be active even when the unit is OFF, then all the actions on the heating actuators described above are active even when the unit is OFF*

9.1| *Frost Prevention in OFF*

FROST PREVENTION IN OFF								
FRO			**Frost**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	FPR		Frost Prevention					
		FP4	Setpoint OFF	5,0	90,0	2,0	°C	
		FP5	Proportional band	0,1	20,0	1,0	K	
		FP6	Integral time	0	9999	0		

Tab 30_ [Frost protection - Frost prevention in OFF]

When the unit is OFF, the controllers works to maintain the "tC2 – Antifreeze" probe, if present, to the value set with the setpoint OFF FP4 with PI logic.

This function acts on both the heat sequences but the heat recovery and the external damper remain closed.

10| Controlling the supply temperature limits

SUPPLY TEMPERATURE LIMITS								
SCT			**Supply Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	STL		TemperatureLimit					
		TL1	Supply temp low limit	-15,0	90,0	16,0	°C	
		TL2	Supply temp high limit	-15,0	90,0	35,0	°C	
		TL3	Supply temp low limit enable	1	2	YES		;NO;YES
		TL4	Band	0,1	20,0	3,0	K	
		TL5	Supply temp high limit enable	1	2	YES	;NO;YES	
		TL6	Band	0,1	20,0	3,0	K	

Tab 31_ [Controlling the supply temperature limits - Supply temperature limits]

10.1| Supply temperature limits in cascade control

(See "7] - Cascade Control") for the way supply temperature is limited in the cascade control.

10.2| Supply temperature lower limit

This function protects the environment and the people therein from the infeed of air that is too cold.

The function is enabled with TL3 and requires setting the lower limit TL1 beyond which the supply temperature must not drop.

Operation in cooling mode

When the supply temperature "SUP - Supply Temp" drops below the lower limit TL1 increased by band TL4, the cooling device and any damper to feed in outside air (free-cooling) are limited in a manner proportional to amount the supply temperature differs from the limit setpoint. Below the setpoint, the limitation is total.

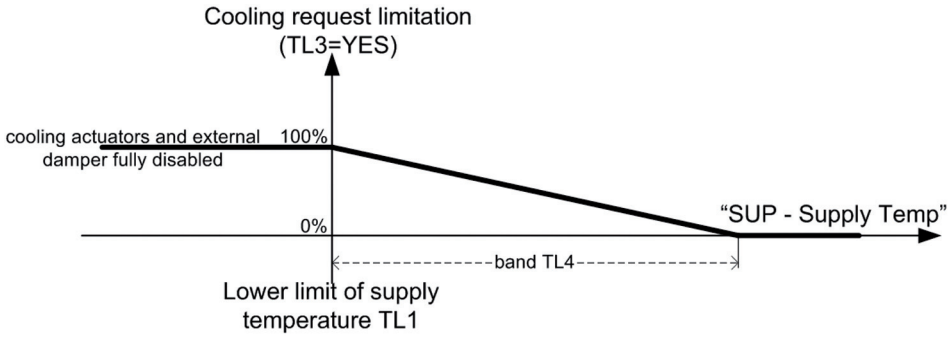

Fig 35_ [Controlling the supply temperature li- Operation in cooling mode]

Operation in dehumidification mode

Limitation is ON/OFF as described in the figure

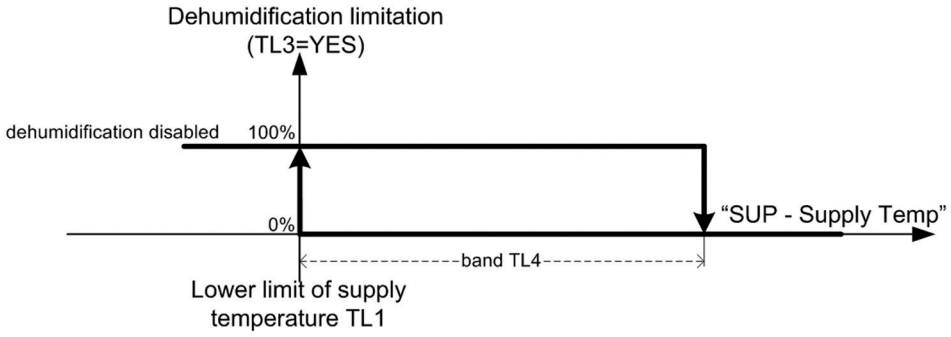

Fig 36_ [Controlling the supply temperature li- Operation in dehumidification mode]

10.3| Supply temperature upper limit

This function protects the environment and the people therein from the infeed of air that is too hot.

The function is enabled with TL5 and requires setting the upper limit TL2 beyond which the supply temperature must not rise.

The behavior mirrors what follows for the lower supply limit. When the supply temperature "SUP - Supply Temp" rises above the upper limit TL2 decreased by band TL6, the heating device and any damper to feed in outside air (free-heating) are limited in a manner proportional to amount the supply temperature differs from the limit setpoint. Above the setpoint, the limitation is total

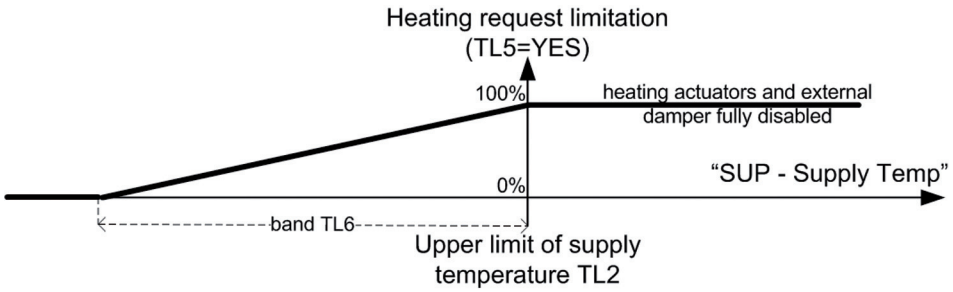

Fig 37_ [Controlling the supply temperature li- Supply temperature upper limit]

11| Humidity control

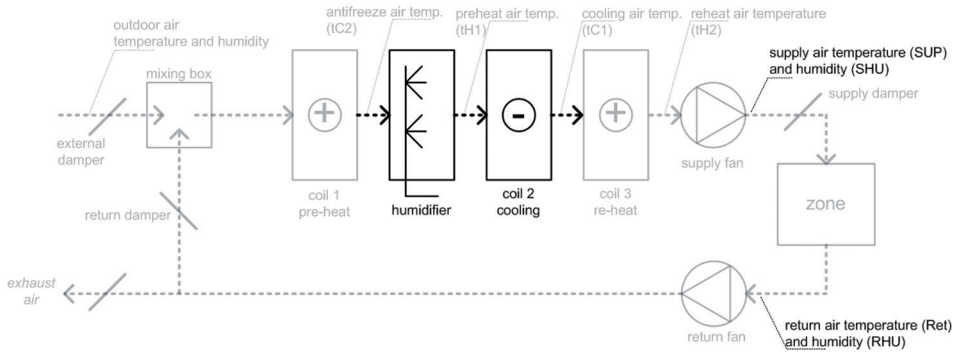

Fig 38_ [Humidity control - Humidity control]

HUMIDITY CONTROL SETPOINT								
SET			**Setpoint**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	MST		Main Setpoint					
		HUM	Min setpoint humidity	0	100,0	40,0	%	
		DEH	Max setpoint humidity	0	100,0	60,0	%	

Tab 32_ [Humidity control - Humidity control setpoint]

HUMIDITY CONTROL REGULATION								
HCT			**Humidity Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	REG		Regulation					
		U01	Control probe	1	3	RHU		;NO;SHU;RHU
		U02	Humidification proportional band	0	20,0	5,0	%	
		U03	Humidification integral time	0	9999	0	SEC	
		U04	Humidification derivative time	0	9999	0	SEC	
		U05	Dehumidification prop. band	0	20,0	5,0	%	
		U06	Dehumidification integral time	0	9999	0	SEC	
		U07	Dehumidification derivative time	0	9999	0	SEC	

Tab 33_ [Humidity control - Humidity control regulation]

11.1| Control sequences

Parameter U01 is used to enable humidity control and defines the probe used for control, i.e. supply humidity "SHU – Sup. Humidity" (U01=SUP) and return "RHU – Ret. Humidity" (U01=REt).

The humidification and dehumidification process is controlled by the selected probe with PID logic based on the following setpoint: minimum setpoint HUM, maximum setpoint DEH.

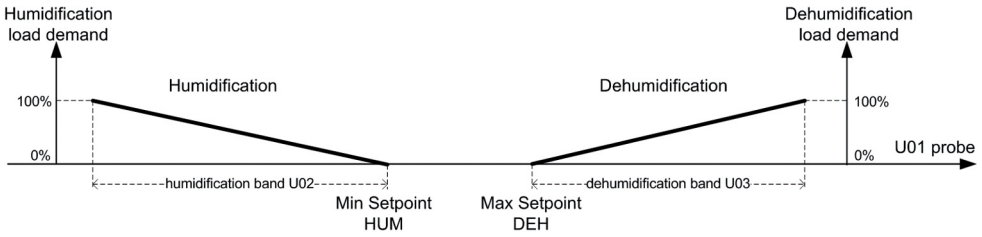

Fig 39_ [Humidity control - Control sequences]

11.2| Humidifier control

The software can handle both ON/OFF and modulating humidifiers, respectively using the digital output "HUM – Humidifier" and the analog output "HUA – Humidifier".

Is possible to manage also a pump with the digital output "HUP – HumidPump".

HUMIDIFIER CONTROL		
Type of output	**Output used**	
digital output	HUM	Humidifier
	HUP	HumidPump
analog output	HUA	Humidifier

Tab 34_ [Humidity control - Humidifier control]

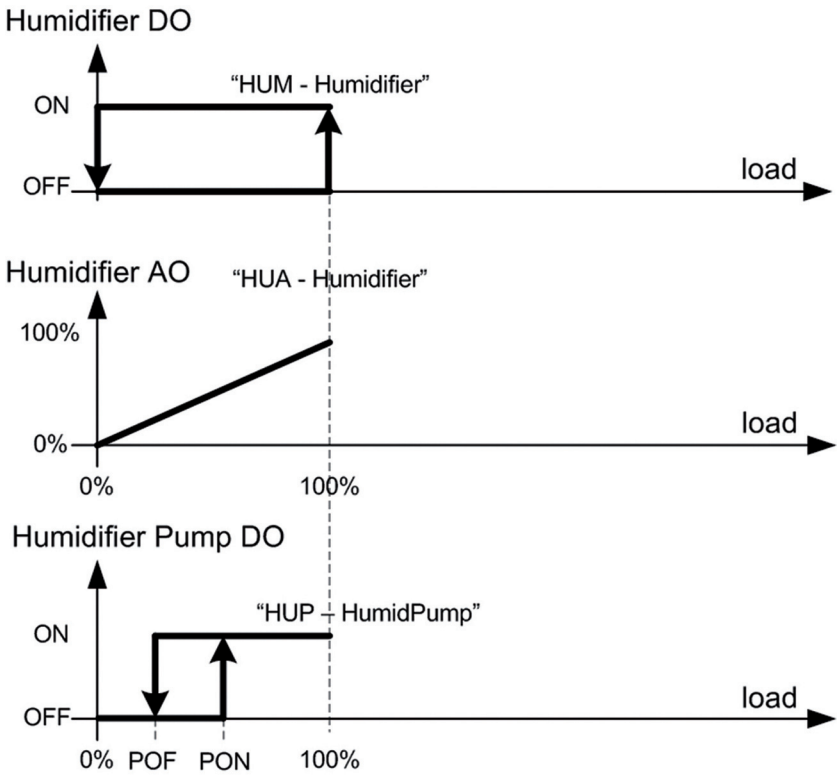

Fig 40_ [Humidity control - Humidifier control]

If present, the pump is activated when request is sent to the humidifier. You can define the load percentage to switch on the pump, via PON parameter, and to switch it OFF, via POF parameter.

Example

** Pump switches ON at 5% and OFF at 0%.*

You can also define a switch OFF delay POd for the pumps.

HUMIDIFICATION PUMPS								
PUM			**Pumps**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	STU		Setup					
		POd	Pump delay at OFF	0	9999	5	SEC	
		PON	Power request activation	0	9999	5,0	%	
		POF	Power request deactivation	0	9999	0,0	%	

Tab 35_ [Humidity control - Humidification pumps]

Note

** Humidification pump is not activated in case of winter start.*

11.3| Dehumidifier control

Dehumidification can be performed:

1. with an outside dehumidifier activated by the digital output "DEU – Dehumidifier "and analog output "DHU – Dehumidifier".

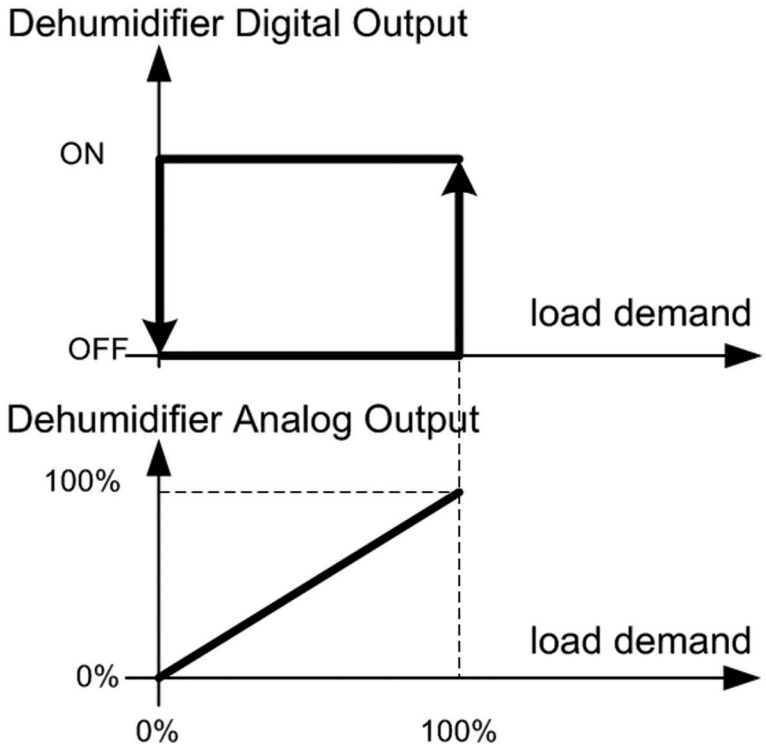

Fig 41_ [Humidity control - Dehumidifier control]

activating the cooling coil (see "11.3.1] Cooling coil in dehumidification").

11.3.1| Cooling coil in dehumidification

COOLING COIL IN DEHUMIDIFICATION								
HCT			**Humidity Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	CCD		Cooling Coil					
		U08	Enable in dehumidification	1	3	YES		;NO;YES
		U09	Control type in dehumidification	1	3	NO		;MAX;DEW POINT;PROP

Tab 36_ [Humidity control - Cooling coil in degumidification]

If a dehumidification request will activate the cooling coil, depends on U08, cooling coil enable in dehumidification.
If U08 = NO then cooling coils are not activated regardless of the dehumidification request.
If U08 = YES, then cooling coil is activated in the following ways according to U09, Control type in dehumidification.

If U09 = MAX, then cooling coil is activated at 100% when the dehumidification load demand is 100%.

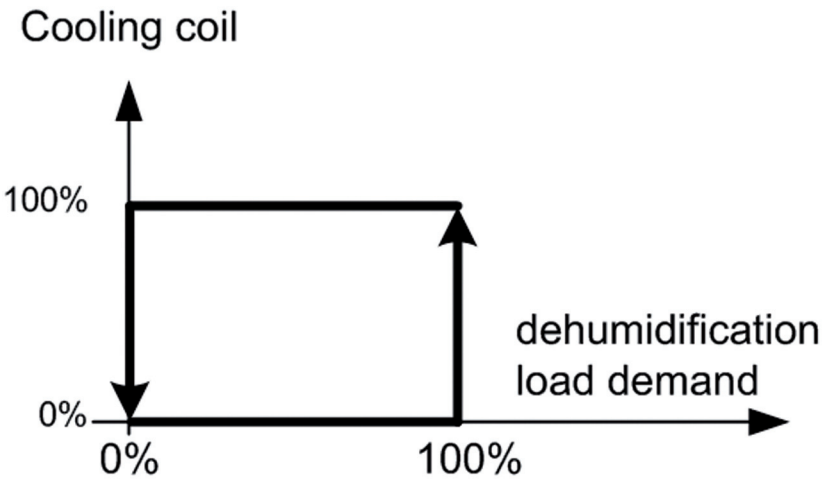

Fig 42_ [Humidity control - Cooling coil in dehumidification 1]

If U09 =DEW POINT, when the dehumidification load demand is 100% then cooling coil is controlled using the tC1 probe to reach the dew point setpoint (calculated on the basis of the cooling coil temperature setpoint and maximum humidity setpoint DEH) .

If tC1 probe is not present, cooling coil is activated at 100% till there is request of dehumidification

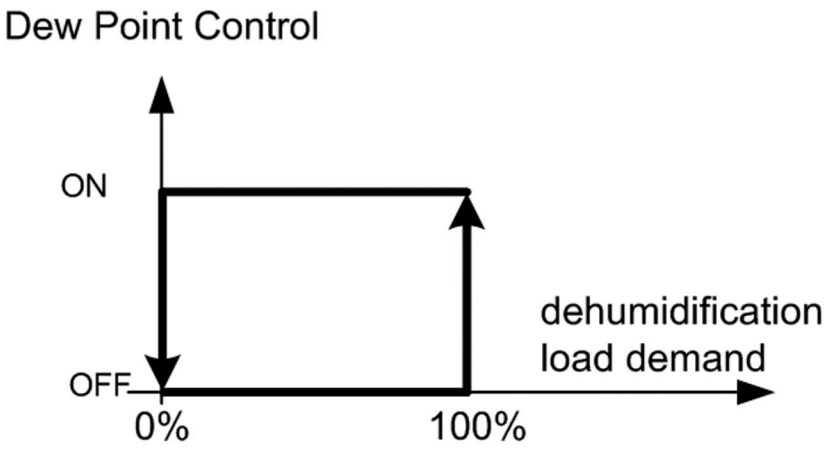

Fig 43_ [Humidity control - Cooling coil in dehumidification 2]

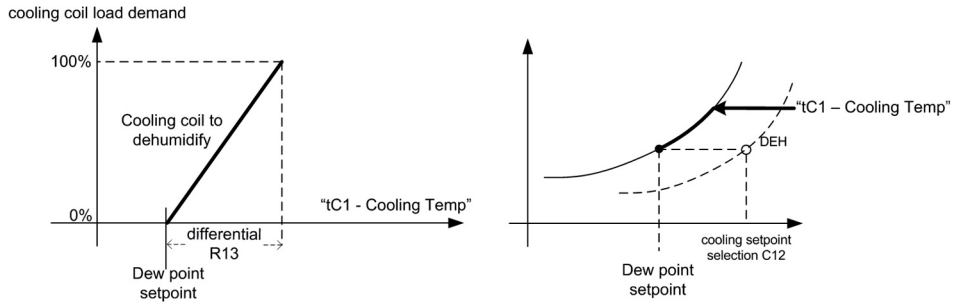

Fig 44_ [Humidity control - Cooling coil in dehumidification 3]

If U09 = PROP, then cooling coil are controlled proportionally to the dehumidification load demand.

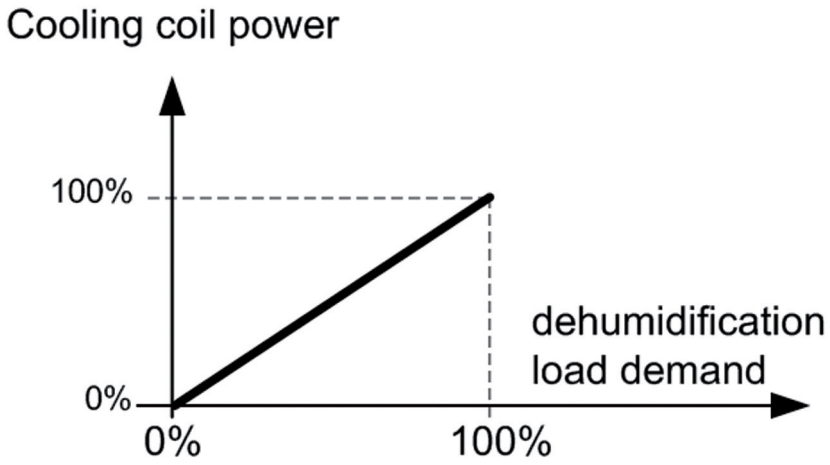

Fig 45_ [Humidity control - Cooling coil in dehumidification 4]

11.4| Controlling the supply humidity limits

CONTROLLING THE SUPPLY HUMIDITY LIMITS								
SCT			**Supply Control**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	SHL		Humidity Limit					
		HL1	Supply humidity low limit	0	100,0	30,5	%	
		HL2	Supply humidity high limit	0	100,0	70,0	%	
		HL3	Supply humidity low limit enable	1	2	YES		;NO;YES
		HL4	Band	1	10,0	5,0	%	
		HL5	Supp. humidity high limit enable	1	2	YES		;NO;YES
		HL6	Band	1	10,0	5,0	%	

Tab 37_ [Humidity control - Controlling the supply humidity limits]

11.4.1| Upper limit

Control of the upper limit for supply humidity prevents the onset of condensation in the supply ducts.

The function is enabled with HL5 and requires setting the upper limit HL2 beyond which the supply humidity must not rise.

In the case of a modulating humidifier, as the supply humidity reaches the upper limit HL2 decreased by band HL6, the controller limits the output to the humidifier in a manner proportional to the amount the supply temperature differs from the setpoint limit. If the unit has an ON/OFF humidifier, it is turned off directly by the upper limit and reactivated after the differential is reached.

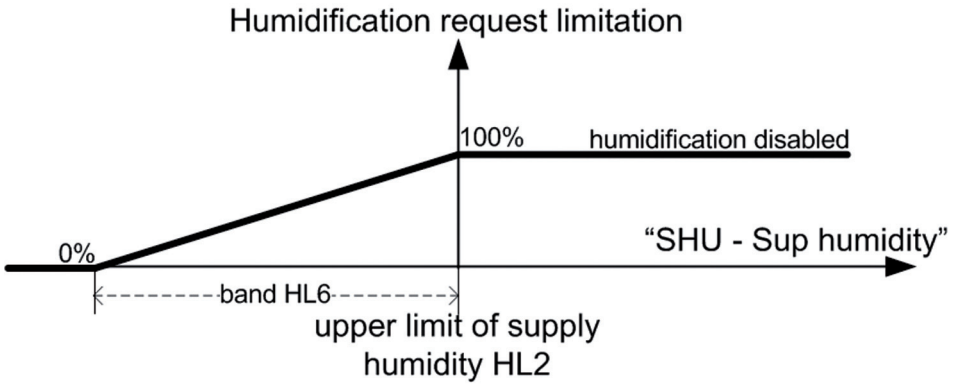

Fig 46_ [Humidity control - Upper limit]

11.4.2| Lower limit

This function protects the environment and the people therein from the infeed of air that is too dry.

The function is enabled with HL3 and requires setting the lower limit HL1 beyond which the supply temperature must not drop and the limit band HL4.

The behavior mirrors what follows for the upper supply limit.

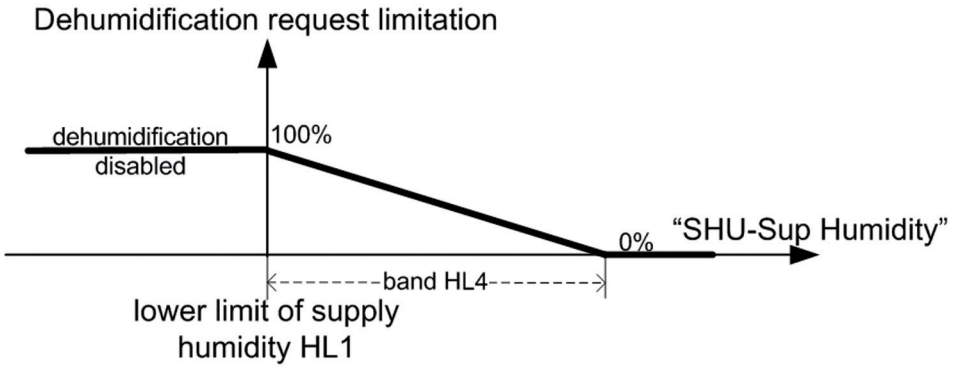

Fig 47_ [Humidity control - Lower limit]

12| Supply and return fans

SUPPLY AND RETURN FANS								
FAN			**Fans**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	GEN		General					
		F00	Fan control type	1	3	ONOF		;ONOF;REQ;PId
		F01	Probe selection	1	3	SUP		;SUP;REt;bAR
		F02	Minimum speed	0,0	F03	0,0	%	
		F03	Maximum speed	F02	100,0	100,0	%	
		F04	Coils OFF with fan OFF	1	2	NO		;NO;YES
		F05	Stop fans for antifreeze	1	2	YES		;NO;YES
	SUF		Supply Fan					
		SF1	Time at maximum speed at startup	0	9999	0	SEC	
		SF2	Anti resonance	0,0	100,0	0,0	%	
		SF3	Anti resonance zone	0,0	50,0	0,0	%	
		SF4	Fan delay at startup	0	9999	5	SEC	
		SF5	Fan delay at OFF	0	9999	5	SEC	
	REF		Return Fan					
		RF1	Time at maximum speed at startup	0	9999	0	SEC	
		RF2	Anti resonance	0,0	100,0	0,0	%	
		RF3	Anti resonance zone	0,0	50,0	0,0	%	
		RF4	Fan delay at startup	0	9999	5	SEC	
		RF5	Fan delay at OFF	0	9999	5	SEC	
	REG		PID Regulation					
		Fr1	Action of regulation	1	4	DIR		;INV;dIR;CO1;CO2
		Fr2	Setpoint	-15,0	110,0	12,0		
		Fr3	Proportional band	0,1	20,0	2,0		
		Fr4	Integral time	0	9999	0	SEC	
		Fr5	Derivative time	0	9999	0	SEC	

Tab 38_ [Supply and return fans - Supply and return fans]

The type of supply fan control is defined using parameter F00.

The return fan, if present, is assumed to be controlled as the supply fan.

Each fan functions only if its dampers are open.

12.1| Type of supply and return fans

The parameters that enable setting the way fan is controlled is F00 – Fan control type.

» If F00=ONOF, the fan is an ON/OFF unit, it starts when the unit is turned on (after delay time SF4 has elapsed) and always remains on except in the case of fan alarms, fire and antifreeze (see "12.3] Fans and antifreeze").
The fan is controlled using the digital output "SUF - Supply Fan".

» If F00=REQ, the fan is only activated when temperature or humidity control action is requested.
The following 3 digital outputs are used to control the fan; they have been conceived to run a fan with a star-delta connection arranged for 2 operating speeds.
"SUF - Supply Fan" – is activated when a control action is requested (line contactor)
"SFL - SupplyFanLow." – is activated as indicated in the figure (star contactor)
"SFH - SupplyFanHigh." – is activated as indicated in the figure (delta contactor)
Then the analog output "SUF - Supply Fan" is used, activated in a manner proportional to the demand.

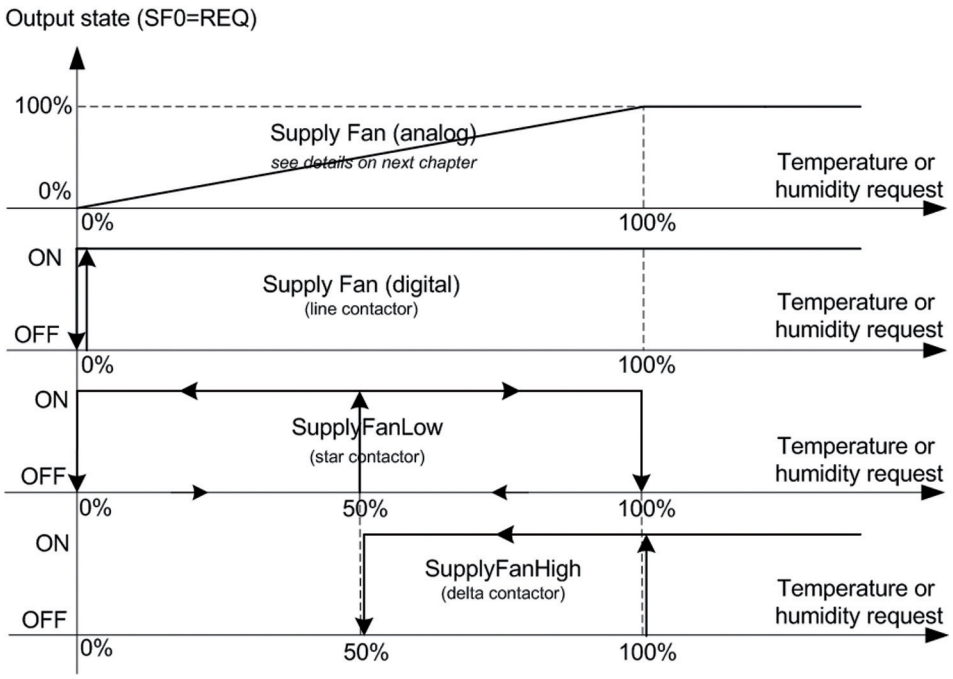

Fig 48_ [Supply and return fans - Type of supply fans]

» If F00=PID, the fan modulates its speed with PID control (parameters Fr3-Fr6) according to a setpoint Fr2 and the value of a control probe, defined by F01 from among the return temperature (F01=REt), supply temperature (F01=SUP) and air pressure "bAR – Air Pressure" (F01=bAR) probes.
The control type is defined in Fr1 from among the following possibilities:

- Fr1=INV. Inverse control, i.e. heating.
- Fr1=DIR. Direct control, i.e. cooling.
- Fr1=CO1. Direct or inverse control according to the operating mode: summer/winter. Direct in summer, inverse in winter.
- Fr1=CO2. Direct or inverse control according to the operating mode: summer/winter. Inverse in summer, direct in winter.

The outputs indicated in the previous point are used to control the fan.
Note that the fan is never stopped if temperature or humidity control action is requested. In this case the fan is set to its minimum speed.
In case of a reference probe failure, the fan is forced to its maximum speed.

Return fan output

As with the supply fan, the outputs used to control the return fan are the digital outputs "REF - Return Fan", "RFL - REt. Fan Low Sp.", "RFH - REt. Fan High Sp" and the analog output "REF - Return Fan".

12.2| Fan speed configuration

In the case of F00=REQ and F00=PID control, the fan speed configuration parameters are described in the figure below where, for the sake of convenience, only the supply fan is indicated.

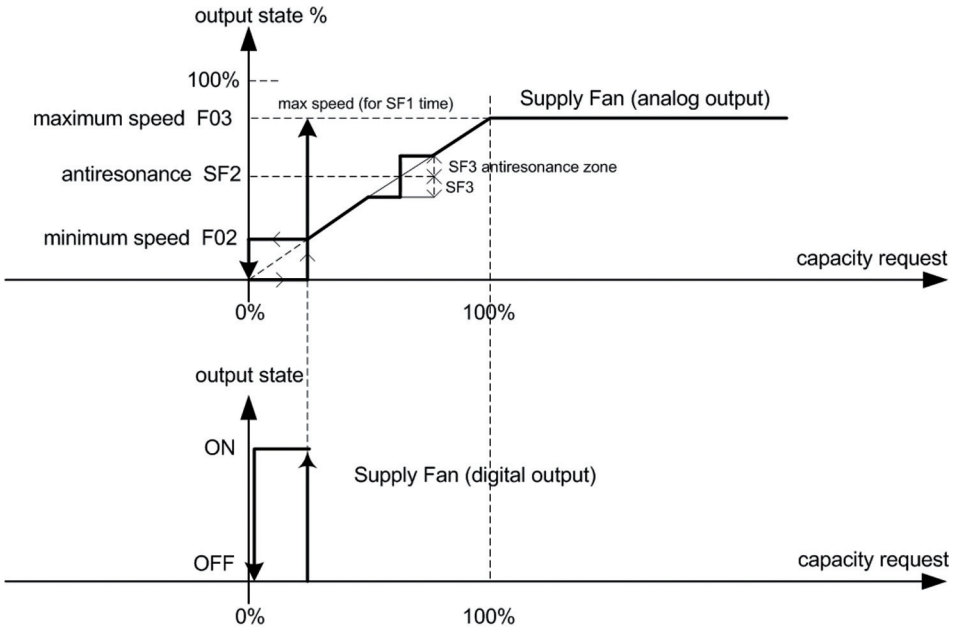

Fig 49_ [Supply and return fans - Fan speed configuration]

The percentage values corresponding to the minimum and maximum fan speeds are defined with F02 and F03; within these values, the modulation output action is calculated as described in the figure.

The fan output is activated when the capacity requested is equal to or greater than that which can be obtained with the fan at minimum speed.

Supply fan

The starting speed is the minimum rate if SF1=0; otherwise SF1 defines the starting breakaway time during which the fan runs at maximum speed F03.

In SF2 it is possible to define a percentage speed you wish to avoid because it corresponds to the resonance frequency. In this case, the fan will avoid speeds that fall between SF2-SF3 and SF2+SF3, as described in the figure.

To allow the damper to open, the supply fan is activated after a delay SF4 has elapsed after the AHU is started up. Then is delayed of SF5 time when the unit is turned off.

Note

** To avoid that coils are working while the fan is not running, the coil power is limited to zero until the fan is able to start at its minimum speed.*

Return fan

Like the supply fan, the start-up speed is minimum if RF1=0; otherwise RF1 defines the start-up breakaway time during which the fan runs at maximum speed F03.

In RF2 it is possible to define a percentage speed you wish to avoid because it corresponds to the resonance frequency. In this case, the fan will avoid speeds that fall between RF2-RF3 and RF2+RF3.

To allow the damper to open, the return fan is activated after a delay RF4 has elapsed after the AHU is started up. Then is delayed of the RF5 time when the unit is turned off.

12.3| Fans and antifreeze

In case of water coils and antifreeze alarm, is necessary to stop fans.

Parameter F04, for stopping regulation if FAN is OFF, must be set to NO

Parameter F05, for stopping FAN if antifreeze alarm is ON, must be set to YES

12.4| Fans lock

Is possible to lock/unlock fans through the digital input "LOF-Lock Fan" or through the user interface (see "2.4.5] Utilities").

13| *Air quality control*

Control of the air quality is performed according to the readings detected by the C02 (carbon dioxide) and VOC (Volatile Organic Compound) probes connected to the analog inputs "CO2 – CO2" and "VOC - VOC". Without these probes, it is still possible to achieve a timed air changeover.

AIR QUALITY CONTROL								
AIR			**Air Quality**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	ACH		Air Change					
		P01	AirChange period	0	9999	5	MIN	
		P02	AirChange duration	0	9999	30	SEC	
	CO2		CO2-VOC Control					
		P03	CO2 setpoint	0	100,0	50,0	%	
		P04	CO2 prop. band	1	10,0	2,0	%	
		P05	VOC setpoint	0	100,0	50,0	%	
		P06	VOC prop. band	1	10,0	2,0	%	

Tab 39_ [Air quality control - Air quality control]

Whether requested by the VOC or CO2 probes or set to be performed at certain intervals, air changeover has priority over damper management. This means that the outside air damper can be opened even if the outside temperature conditions are not favorable to freecooling/freeheating.

If both air quality measurement probes are not present, air changeover is regulated through P01, interval between air changes, and P02 duration of the external damper opening.

If both probes, VOC and CO2, are present, the damper is controlled by the higher of the two signals detected.

A setpoint for CO2 control is defined in P03 with its relative differential P04 and a setpoint for the VOC control is defined in P05 with its relative differential P06.

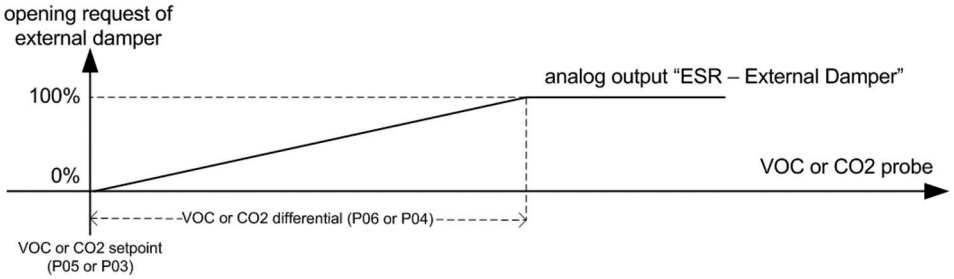

Fig 50_ [Air quality control - Air quality control]

14| Alarms

14.1| Actions following an alarm

When an alarm occurs, the following actions generally ensue (according to what defined through the Configurator software "AHU_Interface_vNN.xls").

- The buzzer sounds, if present and if envisaged by the specific alarm (see "14.3] Alarms table").
- The alarm relay "ALA - Alarm" or the warning "WAR - Warning" is activated depending on what is envisaged by the specific alarm (see "14.3] Alarms table").
  The Configurator can be used to define whether the alarm is activated when the unit is OFF.
  In the absence of a alarm condition, the Normally Closed (N.C.) and Normally Open (N.O.) state of the alarm relay is defined when the physical output is configured. If the polarity is "N.O." (default setting), the relay is powered in case of an alarm.
- The alarm icon is displayed along with the code for the alarm and its description (only for units with LCD display). For a complete description of the user interface in the case of alarms, (see "2] User interface").

14.2| Types of reset

Through the Configurator it is possible to set how the alarms are to be reset: manually, automatically or semi-automatically.

- If reset is manual, a specific procedure is required to resetting them if the alarm condition doesn't exists any more: from the menu (Menu: ALA – Alarms, Sub-menu: RAL – Reset Alarms) to reset all Alarms present or by pressing ENTER from within the alarms display screen to reset only the currently displayed alarm (see "2] User interface").
- If reset is automatic, the alarm is deactivated and the signal disappears as soon as the alarm conditions cease.
- If reset is semi-automatic, it means that reset reverts from automatic to manual after it has occurred a certain (configurable) number of times.

The buzzer is silenced the first time any button is pressed, even if the alarm condition remains in effect; it will remain silent until a new alarm occurs.

14.3| Alarms table

Each alarm is characterized by:

- code: ID tag that unequivocally identifies the alarm and which is displayed on the screen;
- description: displayed only on LCD displays;
- source of the alarm;
- type of reset: (-1=automatic, 0=manual, >0=number of occurrences for semi-automatic alarms);;
- if semi-automatic alarms, the period for counting alarm occurrences; if during this time the alarm exceeds its maximum number of occurrences, it becomes a manual reset alarm;
- delays for detecting the alarm after start-up and when in steady operation;
- whether it is active even when the machine is in standby mode;
- how it affects the alarm relay, warning and buzzer;
- how it affects the unit actuators

as described in the table below.

The columns in grey contain data that can be modified with the Configurator software

ALARMS TABLE

Code	Description	Source	Type of reset	Semi automatic period (min)	Delay at start-up	Operating delay	Active with unit OFF	Alarm relay	Warning relay	Buzzer	Actuators OFF
A01	Supply fan alarm	Digital input "SupFan Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Supply fan
A02	External damper locked	Digital input "ExtDamp Closed" and output "External Damper" active	-1 (automatic)	0	0	3	NO	YES	YES	YES	Supply fan

ALARMS TABLE

Code	Description	Source	Type of reset	Semi automatic period (min)	Delay at start-up	Operating delay	Active with unit OFF	Alarm relay	Warning relay	Buzzer	Actuators OFF
A03	Supply fan safety switch	Digital input "SupFan SafeSW"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Supply fan
A04	Return fan alarm	Digital input "RetFan Alarm	-1 (automatic)	0	0	0	NO	YES	YES	YES	Return fan
A05	Mixing damper locked	Digital input "MixDamp Closed" and output "Mixing Damper" active	-1 (automatic)	0	0	3	NO	YES	YES	YES	Return fan
A06	Return fan safety switch	Digital input "RetFan SafeSW	-1 (automatic)	0	0	0	NO	YES	YES	YES	Return fan
A07	Freeze alarm	Digital input "Freeze Alarm" or Analog input (defined in FP1) <= FP2	-1 (automatic)	0	0	0	NO	YES	YES	YES	See "9 Frost protection"
A08	Fire alarm	Digital input "Fire Alarm"	0 (manual)	0	0	0	YES	YES	YES	YES	All
A09	Supply air flow alarm	Digital input "Supply Flow"	0 (manual)	0	10	5	NO	YES	YES	YES	Supply fan
A10	Return air flow alarm	Digital input "Return Flow"	0 (manual)	0	10	5	NO	YES	YES	YES	Return fan
A11	Supply filter alarm	Digital input "Supply Filter"	0 (manual)	0	10	5	NO	YES	YES	YES	None
A12	Return filter alarm	Digital input "Return Filter"	0 (manual)	0	10	5	NO	YES	YES	YES	None
A13	Pump 1 overload	Digital input "Coil1 Pump"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Pump 1
A14	Pump 2 overload	Digital input "Coil2 Pump"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Pump 2
A15	Pump 3 overload	Digital input "Coil3 Pump"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Pump 3
A16	Coil 1 alarm	Digital input "Coil1 Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Coil 1
A17	Coil 2 alarm	Digital input "Coil2 Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Coil 2
A18	Coil 3 alarm	Digital input "Coil3 Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Coil 3
A19	Humidifier alarm	Digital input "Humidifier Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Humidifier and pump
A20	Recovery alarm	Digital input "RecoveryAlarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	Recovery and pump
A21	Generic alarm	Digital input "Generic Alarm"	-1 (automatic)	0	0	0	NO	YES	YES	YES	None
AEX	No connection with EXC Module	Communication error with EXC extension	-1 (automatic)	0	30	5	NO	YES	YES	NO	Actuators involved
E01	Analog Input 1 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E02	Analog Input 2 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E03	Analog Input 3 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E04	Analog Input 4 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E05	Analog Input 5 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E06	Analog Input 6 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved

ALARMS TABLE											
Code	Description	Source	Type of reset	Semi automatic period (min)	Delay at start-up	Operating delay	Active with unit OFF	Alarm relay	Warning relay	Buzzer	Actuators OFF
E07	Analog Input 7 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E08	Analog Input 8 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E09	Analog Input 9 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E10	Analog Input 10 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E11	Analog Input 11 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E12	Analog Input 12 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E13	Analog Input 13 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E14	Analog Input 14 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E15	Analog Input 15 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved
E16	Analog Input 16 fault	Probe open or short circuited	-1 (automatic)	0	20	10	NO	YES	YES	NO	Actuators involved\

Tab 40_ [Alarms - Alarms table]

15| Parameters

The parameters are broken down into groups according to the type of function performed.

The characteristics described below are defined for each parameter; these can take on numerical values or can depend on that of another parameter specified in the tag.

All characteristics described can be modified through the Configurator software "AHU_Interface_vNN.xls".

Group1, **Group2**: indicates what group and subgroup the parameter displayed during navigation of the parameters directory belong to:

Parameter: ID tag for the parameter. Unequivocally identifies the parameter.

Description: describes the parameter shown on the LCD display

K: indicates a parameter that cannot be modified (constant with default value); does not appear on the display

Min: lowest possible value for the parameter

Max: highest possible value for the parameter

Default: factory-installed value

U.M: indicates the unit of measure

Decimals: number of decimal points

R/W: indicates whether the parameter is read only (RW=1), or in read-write mode (RW=0)

Visibility: specifies whether parameter visibility is a function of another parameter.

Level: the parameters are organized in 4 levels. Levels 1 to 3 are associated with a password. It is not possible to display parameters of a level higher than the access level; on the other hand, it is possible to view parameters belonging to levels lower than or equal to the access level

» level 0 can be accessed without a password,

» level 1, easy access, groups together the parameter which are not critical for machine function and which are frequently modified;

» level 2 groups together all parameter which are useful during machine installation;

» level 3 groups together all parameter reserved for the manufacturer.

Text Values: list of mnemonic values that can be assumed by the parameter

The parameter display and modification mode is accessed from the Menu. For a complete description of the user interface, (see "2] User interface").

15.1| Parameters table

See the Configurator software "AHU_Interface_vNN.xls" for the list of parameters.

16| *Modbus Communication*

The communication protocol supported by the RS485 network is the Modbus RTU slave

MODBUS COMMUNICATION								
GEN			**General**	**Min**	**Max**	**Default**	**U.M.**	**Text value**
	SEr		Modbus					
		SEr	Modbus address	1	254	1		
		bAU	Baudrate	1	9	192		;0;12;24;48;96;144;192;288;384
		COM	Settings	1	3	8N1		;8N1;8E1;8N2

Tab 41_ [Modbus Communication - Modbus Communication]

The following communications settings can be set:

SEr - Serial address (Modbus and CAN)

Serial node address setting, valid both for the Modbus and CAN networks. Each node on the network must have an unequivocal address

bAU – Serial Baudrate (Modbus)

- » bAU=0. communication disabled
- » bAU=12. baudrate=1200 baud
- » bAU=24. baudrate=2400 baud
- » bAU=48. baudrate=4800 baud
- » bAU=96. baudrate=9600 baud
- » bAU=144. baudrate=1440 baud
- » bAU=192. baudrate=19200 baud (default value)
- » bAU=288. baudrate=28800 baud
- » bAU=384. baudrate=38400 baud

COM – Serial settings

- » COM=8N1. 8 data bits, no parity, 1 stop bit
- » COM=8E1. 8 data bits, parity even, 1 stop bit
- » COM=8N2. 8 data bits, no parity, 2 stop bits

The exported variables are of the "Holding Register" or "Coil" type.

16.1| Table of exported variables

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Coil Address**
	Digital input			
	Not Used			1
ASF	SupFan Alarm	SupFan Alarm	R	2
SSS	SupFan SafeSW	Supply Fan safety switch (port open)	R	3
ASR	RetFan Alarm	Return Fan alarm	R	4
CSR	MixDamp Closed	Mixing Damper closed	R	5
SSR	RetFan SafeSW	Return Fan safety switch	R	6
CSE	ExtDamp Closed	External Damper closed	R	7
ONF	ON/OFF	ON/OFF	R	8
AFI	Fire Alarm	Fire alarm	R	9
AAI	Freeze Alarm	Freeze alarm	R	10
CH	Summer/Winter	Summer/Winter selection	R	11
SFW	Supply Flow	Supply flow alarm	R	12

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Coil Address**
RFW	Return Flow	Return flow alarm	R	13
SFI	Supply Filter	Supply air filter plugged	R	14
RFI	Return Filter	Return air filter plugged	R	15
PU1	Coil1 Pump	Coil 1 pump alarm	R	16
PU2	Coil2 Pump	Coil 2 pump alarm	R	17
PU3	Coil3 Pump	Coil 3 pump alarm	R	18
HUM	HumidifierAlarm	Humidifier alarm	R	19
REC	RecoveryAlarm	Energy recovery alarm	R	20
GEN	Generic Alarm	Generic alarm	R	21
bA1	Coil1 Alarm	Coil 1 alarm	R	22
bA2	Coil2 Alarm	Coil 2 alarm	R	23
bA2	Coil3 Alarm	Coil 3 alarm	R	24
LOF	Lock Fan	Lock/Unlock fans	R	25
COE	Comf/Eco	Comfort/Economy selection	R	26
FDI	FreeHeatCool	Freeheat/Freecool changeover	R	27
	Not Used			28 - 64
	Digital Output			
	Not Used			65
ALA	Alarm	Alarm	R	66
WAR	Warning	Warning	R	67
SUF	Supply Fan	Supply Fan control	R	68
REF	Return Fan	Return Fan control	R	69
RDD	Mixing Damper	Mixing Damper control	R	70
EDD	External Damper	External Damper control	R	71
SFL	SupplyFanLow	Low Supply Fan speed	R	72
SFH	SupplyFanHigh	High Supply Fan speed	R	73
RFL	ReturnFanLow	Low Return Fan speed	R	74
RFH	ReturnFanHigh	High Return Fan speed	R	75
dEU	Dehumidifier	External dehumidifier control	R	76
HUM	Humidifier	External humidifier control	R	77
HUP	HumPump	Humidifier pump control	R	78
ERD	Recovery	Energy recovery control	R	79
ERP	Recovery Pump	Energy recovery pump control	R	80
b1	Valve1ONOFF	Controls the ON/OFF valve of coil 1	R	81
b1O	Valve1Open	Controls opening of 3-point valve of coil 1	R	82
b1C	Valve1Close	Controls closing of 3-point valve of coil 1	R	83
b11	Coil1Step1	Controls step 1 of coil 1	R	84
b12	Coil1Step2	Controls step 2 of coil 1	R	85
b13	Coil1Step3	Controls step 3 of coil 1	R	86
CP1	Coil1Pump	Coil1 pump control	R	87
b2	Valve2ONOFF	Controls the ON/OFF valve of coil 2	R	88
b2O	Valve2Open	Controls opening of 3-point valve of coil 2	R	89
b2C	Valve2Close	Controls closing of 3-point valve of coil 2	R	90
b21	Coil2Step1	Controls step 1 of coil 2	R	91
b22	Coil2Step2	Controls step 2 of coil 2	R	92
b23	Coil2Step3	Controls step 3 of coil 2	R	93

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Coil Address**
CP2	Coil2Pump	Coil2 pump control	R	94
b3	Valve3ONOFF	Controls the ON/OFF valve of coil 3	R	95
b3O	Valve3Open	Controls opening of 3-point valve of coil 3	R	96
b3C	Valve3Close	Controls closing of 3-point valve of coil 3	R	97
b31	Coil3Step1	Controls step 1 of coil 3	R	98
b32	Coil3Step2	Controls step 2 of coil 3	R	99
b33	Coil3Step3	Controls step 3 of coil 3	R	100
CP3	Coil3Pump	Coil3 pump control	R	101
dEF	Defrost	Defrost activation	R	102
HRE	HeatRequest	Request of heating	R	103
CRE	CoolRequest	Request of cooling	R	104
	Not Used			105 - 128
	Device state			
	Standby Device State	0=ON, 1=OFF	R/W	129
	Alarm Device State	0= not in alarm mode, 1=in alarm mode	R	130
	Alarms recognized	0=YES, 1=NO	R	131
	Summer/Winter	0=Summer, 1=Winter	R	132
	Reserved		R	133
	Lock Fans	0=Unlocked, 1=locked	R	134
	Frost Protection	0=NO, 1=YES	R	135
	Not Used			136 – 144
	Status Supply FAN	0=OFF, 1=ON	R	145
	Status Return FAN	0=OFF, 1=ON	R	146
	Reserved		R	147 - 155
	Status Damper FreeCooling	0=OFF, 1=ON	R	156
	Status Damper FreeHeating	0=OFF, 1=ON	R	157
	Reserved			158 – 169
	Status Pumps	0=OFF, 1=ON	R	170
	Status Recovery FreeCooling	0=OFF, 1=ON	R	171
	Status Recovery FreeHeating	0=OFF, 1=ON	R	172
	Status Humidifier	0=OFF, 1=ON	R	173
	Status Dehumidifier	0=OFF, 1=ON	R	174
	Not Used			175 - 176
	Alarms			
	Not Used			177
A01	Supply fan alarm	0=OFF, 1=ON	R	178
A02	External damper locked	0=OFF, 1=ON	R	179
A03	Supply fan safety switch	0=OFF, 1=ON	R	180
A04	Return fan alarm	0=OFF, 1=ON	R	181
A05	Mixing damper locked	0=OFF, 1=ON	R	182
A06	Return fan safety switch	0=OFF, 1=ON	R	183
A07	Freeze alarm	0=OFF, 1=ON	R	184
A08	Fire alarm	0=OFF, 1=ON	R	185
A09	Supply air flow alarm	0=OFF, 1=ON	R	186
A10	Return air flow alarm	0=OFF, 1=ON	R	187

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Coil Address**
A11	Supply filter alarm	0=OFF, 1=ON	R	188
A12	Return filter alarm	0=OFF, 1=ON	R	189
A13	Pump 1 overload	0=OFF, 1=ON	R	190
A14	Pump 2 overload	0=OFF, 1=ON	R	191
A15	Pump 3 overload	0=OFF, 1=ON	R	192
A16	Coil 1 alarm	0=OFF, 1=ON	R	193
A17	Coil 2 alarm	0=OFF, 1=ON	R	194
A18	Coil 3 alarm	0=OFF, 1=ON	R	195
A19	Humidifier alarm	0=OFF, 1=ON	R	196
A20	Recovery alarm	0=OFF, 1=ON	R	197
A21	General alarm	0=OFF, 1=ON	R	198
AEX	No connection with EXC Module	0=OFF, 1=ON	R	199
E01	Analog Input 1 fault	0=OFF, 1=ON	R	200
E02	Analog Input 2 fault	0=OFF, 1=ON	R	201
E03	Analog Input 3 fault	0=OFF, 1=ON	R	202
E04	Analog Input 4 fault	0=OFF, 1=ON	R	203
E05	Analog Input 5 fault	0=OFF, 1=ON	R	204
E06	Analog Input 6 fault	0=OFF, 1=ON	R	205
E07	Analog Input 7 fault	0=OFF, 1=ON	R	206
E08	Analog Input 8 fault	0=OFF, 1=ON	R	207
E09	Analog Input 9 fault	0=OFF, 1=ON	R	208
E10	Analog Input 10 fault	0=OFF, 1=ON	R	209
E11	Analog Input 11 fault	0=OFF, 1=ON	R	210
E12	Analog Input 12 fault	0=OFF, 1=ON	R	211
E13	Analog Input 13 fault	0=OFF, 1=ON	R	212
E14	Analog Input 14 fault	0=OFF, 1=ON	R	213
E15	Analog Input 15 fault	0=OFF, 1=ON	R	214
E16	Analog Input 16 fault	0=OFF, 1=ON	R	215

Tab 42_ [Modbus Communication - Table of exported variabiles 1]

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Register Address**
	Digital inputs (physical values)			
	Digital input	bit 0 (0000 0000 0000 0001) -> Digital input 1 ... bit 15 (1000 0000 0000 0000) -> Digital input 16	R	1
	Digital input	bit 0 (0000 0000 0000 0001) -> Digital input 17 ... bit 15 (1000 0000 0000 0000) -> Digital input 32	R	2
	Digital outputs (physical values)			
	Digital output	bit 0 (0000 0000 0000 0001) -> Digital output 1 ... bit 15 (1000 0000 0000 0000) -> Digital output 16	R	3

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Register Address**
	Digital output	bit 0 (0000 0000 0000 0001) -> Digital output 17 ... bit 15 (1000 0000 0000 0000) -> Digital output 32	R	4
	Analog inputs (physical values)			
	Analog input 1		R	5
	Analog input 2		R	6
	Analog input 3		R	7
	Analog input 4		R	8
	Analog input 5		R	9
	Analog input 6		R	10
	Analog input 7		R	11
	Analog input 8		R	12
	Analog input 9		R	13
	Analog input 10		R	14
	Analog input 11		R	15
	Analog input 12		R	16
	Analog input 13		R	17
	Analog input 14		R	18
	Analog input 15		R	19
	Analog input 16		R	20
	Analog outputs (physical values)			
	Analog output 1		R	21
	Analog output 2		R	22
	Analog output 3		R	23
	Analog output 4		R	24
	Analog output 5		R	25
	Analog output 6		R	26
	Internal variables			
	Damp FH Setpoint		R	27
	Damp FC Setpoint		R	28
	Heat seq. 1 Setpoint		R	29
	Heat seq. 2 Setpoint		R	30
	Cool seq. 1 Setpoint		R	31
	Main Hum Setpoint		R	32
	Main DeHum Setpoint		R	33
	Damper Probe		R	34
	Heat1 Probe		R	35
	Heat2 Probe		R	36
	Cool1 Probe		R	37
	Humid Probe		R	38
	Recovery Req. Power		R	39
	Ext. Damper Req. Power		R	40
	Heat1 Req. Power		R	41
	Heat2 Req. Power		R	42

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Register Address**
	Cool1 Req. Power		R	43
	Humidifier Req. Power		R	44
	Dehumidifier Req. Power		R	45
	Reserved		R	46
	Parameters			
	first parameter	See Configurator	R/W	8194
	.....			
	Analog inputs (function)			
	Not Used			9249
SUP	Supply Temp	Supply air temperature	R	9250
REt	Return Temp	Return air temperature	R	9251
OUt	Outside Temp	Outside air temperature	R	9252
tH1	Preheat Temp	Pre-heating temperature	R	9253
tH2	Reheat Temp	Reheat Temp	R	9254
tC1	Cooling Temp	Cooling temperature	R	9255
tC2	AntiFreeze	Antifreeze temperature	R	9256
bAR	Air Pressure	Air pressure	R	9257
SHU	Sup. Humidity	Supply air humidity	R	9258
RHU	Ret. Humidity	Return air humidity	R	9259
CO2	CO2	Air carbon dioxide (CO2) measurement	R	9260
VOC	VOC	Air volatile organic compounds (VOC) measurement	R	9261
	Analog outputs (function)			
	Not Used			10065
SUF	Supply Fan	Supply Fan control	R	10066
REF	Return Fan	Return Fan control	R	10067
RDA	Mixing damper	Mixing damper control	R	10068
EDA	External Damper	External damper control	R	10069
HUA	Humidifier	Humidifier control	R	10070
bA1	Valve1	Valve 1 control	R	10071
bA2	Valve2	Valve 2 control	R	10072
bA3	Valve3	Valve 3 control	R	10073
DHU	Dehumidifier	Dehumidifier control	R	10074
ERA	Recovery	Energy recovery control	R	10075
	Internal variables			
	Reserved		R	16641 - 16648
	Main set heat		R	16649
	Main set cool		R	16650
	Cascade set heat		R	16651
	Cascade set cool		R	16652
	Reserved		R	16653-16657
	Heating1 Req. Power B1		R	16658
	Heating1 Req. Power B2		R	16659

TABLE OF EXPORTED VARIABILES 1				
Code	**Description**	**Notes**	**R/W**	**Register Address**
	Heating1 Req. Power B3		R	16660
	Cooling1 Req. Power B1		R	16661
	Cooling1 Req. Power B2		R	16662
	Cooling1 Req. Power B3		R	16663
	Heating2 Req. Power B1		R	16664
	Heating2 Req. Power B2		R	16665
	Heating2 Req. Power B3		R	16666
	Heat1 Req. Power		R	16667
	Heat2 Req. Power		R	16668
	Cool1 Req. Power		R	16669
	Humidifier Req. Power		R	16670
	Dehumidifier Req. Power		R	16671
	Ext. Damper Req. Power		R	16672
	Recovery Req. Power		R	16673
	Damper Probe		R	16674
	Heat1 Probe		R	16675
	Heat2 Probe		R	16676
	Cool1 Probe		R	16677
	Humid Probe		R	16678
	Frost Probe		R	16679
	Frost Prevention Probe		R	16680
	Damp FC Set point		R	16681
	Damp FH Set point		R	16682
	Heat1 Set point		R	16683
	Heat2 Set point		R	16684
	Cool1 Set point		R	16685
	Frost Set point OFF		R	16686
	CHM1		R	16687
	CHM2		R	16688
	Frost Req. Power		R	16689
	Frost Prevention Req. Power		R	16690
	Supply temp low limit power		R	16691
	Supply temp high limit power		R	16692
	Supply humidity low limit power		R	16693
	Supply humidity high limit power		R	16694
	DeHuCool1 Req. Power		R	16695
	AI Temp Air Cooling		R	16696
	AI Temp Air Return		R	16697
	AI Temp Air Supply		R	16698

Tab 43_ [Modbus Communication - Table of exported variabiles 2]

17| APPENDIX – Use of the Configurator

It is possible to modify the way parameters and alarms are managed. This is done using the Configurator software "AHU_Interface_vNN.xls".

It is also necessary to have a USB-to-485 converter to connect the PC to the RS485 port of the control MCX.

17.1| Guide to modifying the application software

1. To modify the application software, open the Configurator software "AHU_Interface_vNN.xls".
2. Go to the "Generate" page and select:

» the desired model MCX,
» the language to be used,
» the possibility of changing assignment of inputs/outputs from the User interface (NO, if the check box "Use Static Input/Output" is selected; this selection reduces the amount of memory used by the algorithm)
» whether the expansion EXC is used; in this case, use the model indicated by "MCX20 - ---- MCX**+EXC06" for configuration of the inputs/outputs. All I/Os that do not belong to the MCX model used will automatically be considered on the expansion.
» whether only a LED display is available (this selection reduces the amount of memory used by the algorithm)

3. Make the desired modification by going to the pertinent page. The following can be modified:

» navigation menu, from the "Main_Menu" page,
» parameters, from the "Parameters" and "Parameters_x_Model" pages,
» alarms, from the "Alarms page,
» input and output configuration, from the "Digital_Input", "Digital_Output", "Analog_Input", "Analog_Output" pages.

For details as to how to make the modifications, see the following paragraphs regarding the individual pages.

4. Go to the "Generate" page and press "Generate". This generates a new version of the source file "AGF_*.c" for parameters and alarms.
5. Compile and download the binary application file on a MCX controller powered and connected with a USB/485 converter.. The changes have now been implemented.

17.2| "Parameters" Page

On the "Parameters" page, for each parameter it is possible to change:

» The code of the items in the parameters navigation directory that appears on the LED display (columns "Group1" and "Group2"
» the parameter ID code ("Parameters" column),
» the description that appears on the LCD display,

Note

** To change the description, do not modify the "Current Description" column which is read only (and which shows the description in the language selected on the "Generate" page); instead, modify the column that starts with the suffix for the desired language on the right side of the "Parameters" page, from the column "S" on; for example "IT Description" for the Italian language,*

» minimum, maximum or default value ("Min", "Max", "Default" columns),
» rules that determine visibility according to the values of the other parameters ("Visibility" column),
» access level ("Level" column),
» mnemonic value associated with each value that the parameter can assume ("Text Values" column)
» it is also possible to have the parameter disappear by writing "K" in the "K" column.

17.3| "Alarms" Page

On the "Alarms" page, for each parameter it is possible to change:

- » ID code that appears on the LED display ("Code" column)
- » description (see Note in the previous paragraph regarding parameters)
- » enable state ("Enable" column)
- » type of reset ("Reset type" column) -1=automatic, 0=manual, >0 semiautomatic
- » count time for semiautomatic alarms ("Semiautomatic Period" column). If the number of times the alarm occurs during this period exceeds the number set in the previous column ("Reset type"), the automatic reset reverts to manual reset.
- » start-up delay for connected element ("Startup delay" column) and the steady delay ("Steady delay" column),
- » whether it is active even when the unit is OFF ("Active with unit OFF" column),
- » action on the alarms relay, warning and buzzer ("Alarm relay", "Warning relay" and "Buzzer" columns).

17.4| "Parameters_x_Model" Page

This page lets you assign the attribute "K" and maximum, minimum and default values for the parameter according to the MCX model.

Therefore, this is the place to list all those parameters for which you want different values depending on the hardware the program is to be run on.

If a parameter is present on this page, when you select the MCX model using the pull-down menu on the "Generate" page, the values for that parameter for the selected model are automatically copied from the "Parameters_x_Model" to the "Parameters" page. These will then become the new current values.

** On the "Parameters" page, for the parameter values that were automatically copied from the "Parameters_x_Model" page when the MCX model was selected, the formatting is modified with the addition of italics, bold face and green lettering. This highlights the fact that these parameters should be modified from the "Parameters_x_Model" page. In fact, if the modification is performed directly on the "Parameters" page, they could be overwritten when another MCX model is selected.*

17.5| I/O configuration pages

The "Digital_Input", "Digital_Output", "Analog_Input", "Analog_Output" pages let you assign a function or modify the functions assigned to each individual input/output.

The "Application Function" column lists all functions available. Of these, it is possible to modify the code and description that appears on the MCX display during the configuration of the I/O from the user interface.

On the other hand, in the "Default setup" column, it is possible to configure:

- » polarity of the digital inputs and outputs, i.e. if they are normally open or normally closed ("Polarity" column).
- » "Polarity = N.O." (Normally Open) for a digital input means that it is not active when it is open; instead, for a digital output, it means that the relay is not powered when the output is deactivated.
- » type, from among those available for the selected MCX model ("Type" column),
- » operating range of the analog inputs ("Min" and "Max" column), expressed always with the decimal point.
- » For the temperature probes (NTC and PT1000), it identifies the values beyond which a probe alarm is generated.
- » For the active probes, it indicates the input full scale measurement value.

** For a pressure probe with a range of 0-30 bar, set Min=0 and max=30.0.* ***Pay attention to the decimal point****.*

	Type	Function	Min	Max	Range Min%	Range Max%	Overrange	Filter
Analog Input 1	0-5 V	Air Pressure	**0.0**	**30.0**	10	90	No	1

Tab 44_ [APPENDIX - I/O configuration pages e.g.1]

» Aunction performed by the input/output. The function is selected from among those listed in the "Application Function" column.

» Analog input effective range of working ("Range Min%" and "Range Max%" columns).

» Only for active probes. It is the percentage defining the real working range of the probe.

» Analog input over range admission. States if an error is generated when the input signal is outside its effective working range. If "Overrange=NO" an alarm is generated.

	Type	Function	Min	Max	Range Min%	Range Max%	Overrange	Filter
Analog Input 1	0-5 V	Air Pressure	0.0	30.0	**10**	**90**	No	1

Tab 45_ [APPENDIX - I/O configuration pages e.g.2]

** means that the Analog Input 1 is of 0/5V type and it is used for measuring pressure. As 10% ("Range Min%" value) of (5 - 0)V is 0.5V, and 90% is 4.5V then AI1 effective range is 0.5V – 4.5V and it measures 0 bar at 0.5V and 30bar at 4.5V. Outside this range an alarm is generated.*

» analog input filter. If "Filter=1" the analog input measure is not filtered. The measure is faster but less stable. If "Filter=128" filter is at its maximum. Suggested values goes from 1 to 16..

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