Energy XT PRO
BaseLine Application [A00083xx]

SUMMARY

1 HOW TO USE THIS MANUAL

To facilitate use of the manual, customers may find the following useful:

Call-outs

Callout column:
Callouts on the topics described are placed to the left of the text to allow the user to find the desired information quickly.

Cross references

Cross references:
All the words in *italics* are listed in the index with a reference to the page where they are described in more detail;
the text below serves as an example:
"activation of the alarm stops the compressors"
The italics indicate that under Compressors in the index there is a reference to the page where compressors are described in more detail.
If the online Help on the PC is used, the words in italics become proper hyperlinks (automatic links activated with a click of the mouse) that connect the different sections in the manual and allow you to navigate through the document.

Highlighted icons

Some parts of the text are highlighted in the callout column using icons that have the following meanings:

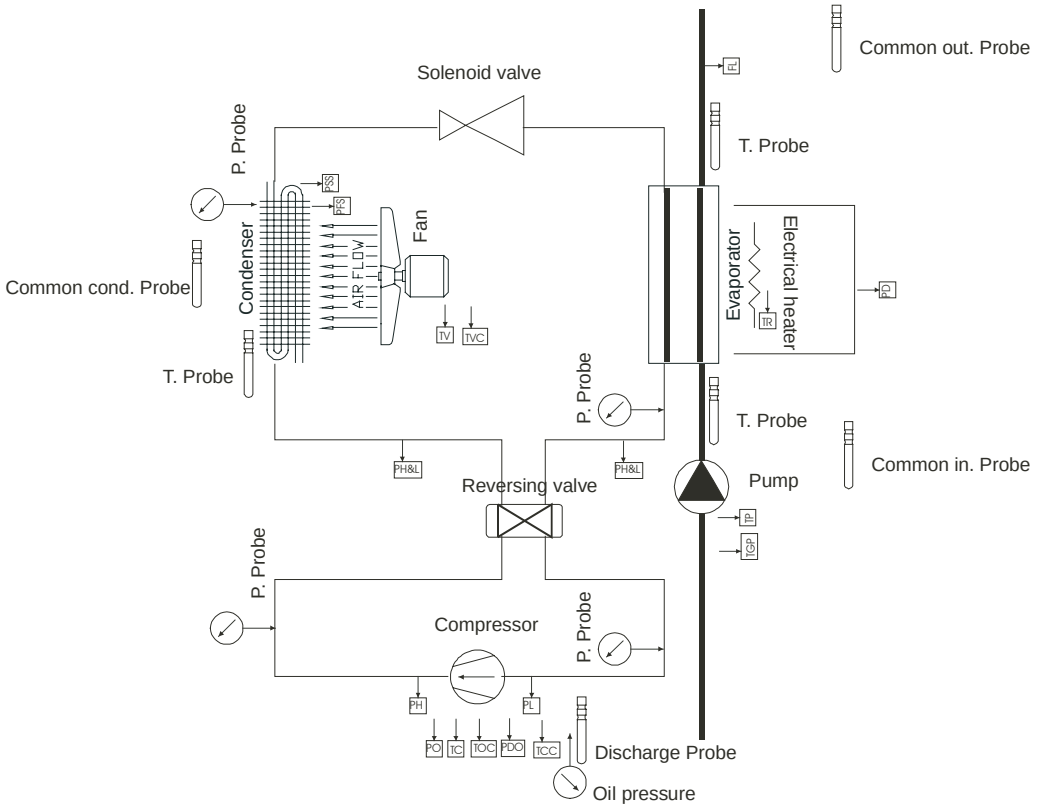
Note: draws attention to a specific topic that users should take into account.

Tip: highlights a suggestion that helps users to understand and use the information on the topic described.

Warning! : **highlights information that may damage the system or place persons, equipment, data, etc at risk if not known. These sections must always be read prior to use.**

2 SYSTEM CONFIGURATION

The Base-line chiller is a “Water-Air” machine, featuring the following components:

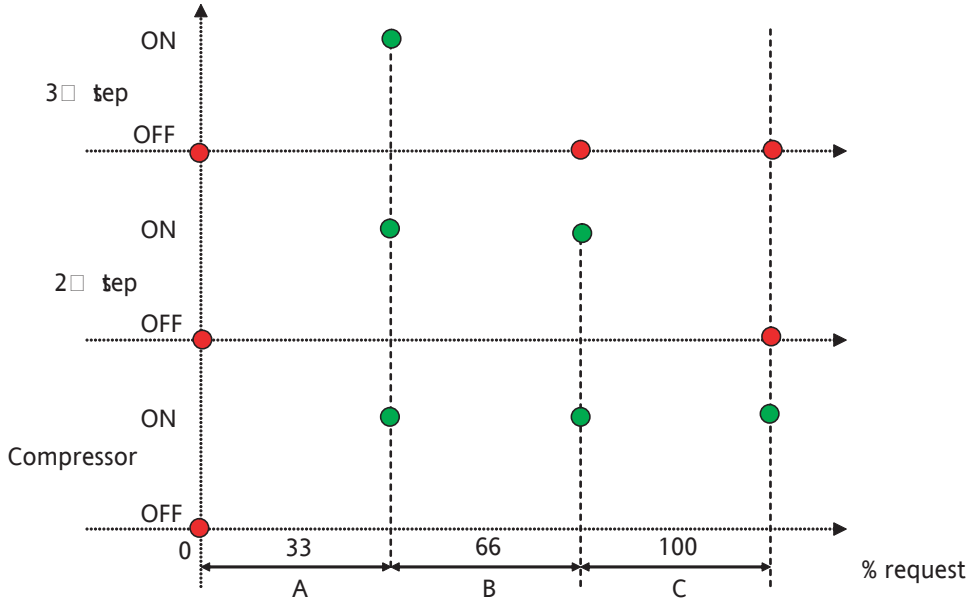


Number of circuits	4
Number of evaporators	2
Number of condensers	4
Number of fan blocks	2

Number of fans per block	4 stepped or 1 continuous
Number of compressors	4
Number of pumps	2
Number of heaters	2

Type of compressors

The application can manage up to 4 alternating compressors with 4 *capacity steps:*



3 FUNCTIONS

Depending on the parameter TREG_TEMP_SENS, temperature control can occur according to the water temperature at the outlet from the thermodynamic system, or the water at the thermodynamic system inlet.
The control setpoint is also calculated according to the status of parameter (TREG_TEMP_SENS); the following gives the behaviour and status of the temperature controller according to the setting of the parameter:

Cooling Mode

	TREG_TEMP_SENS	
	=ENTRY_SENSOR	**=EXIT_SENSOR**
temperature control setpoint	CH_ENTRY_OFFSET+ CH_TSET_TEMP+ Dynamic setpoint correction	CH_TSET_TEMP+ Dynamic setpoint correction
temperature control sensor	PLAN_TEMP_INWATER_SENS_PHY	PLAN_TEMP_OUTWATER_SENS_PHY

Heating Mode

	TREG_TEMP_SENS	
	=ENTRY_SENSOR	**=EXIT_SENSOR**
temperature control setpoint	HP_TSET_TEMP- CH_ENTRY_OFFSET+ Dynamic setpoint correction	HP_TSET_TEMP+ Dynamic setpoint correction
temperature control sensor	PLAN_TEMP_INWATER_SENS_PHY	PLAN_TEMP_OUTWATER_SENS_PHY

3.1 Types of temperature control

The type of temperature *control* to be used can be selected by setting the TREG_FUNCTION parameter.
The Base-Line application provides for the possible use of three different methods:

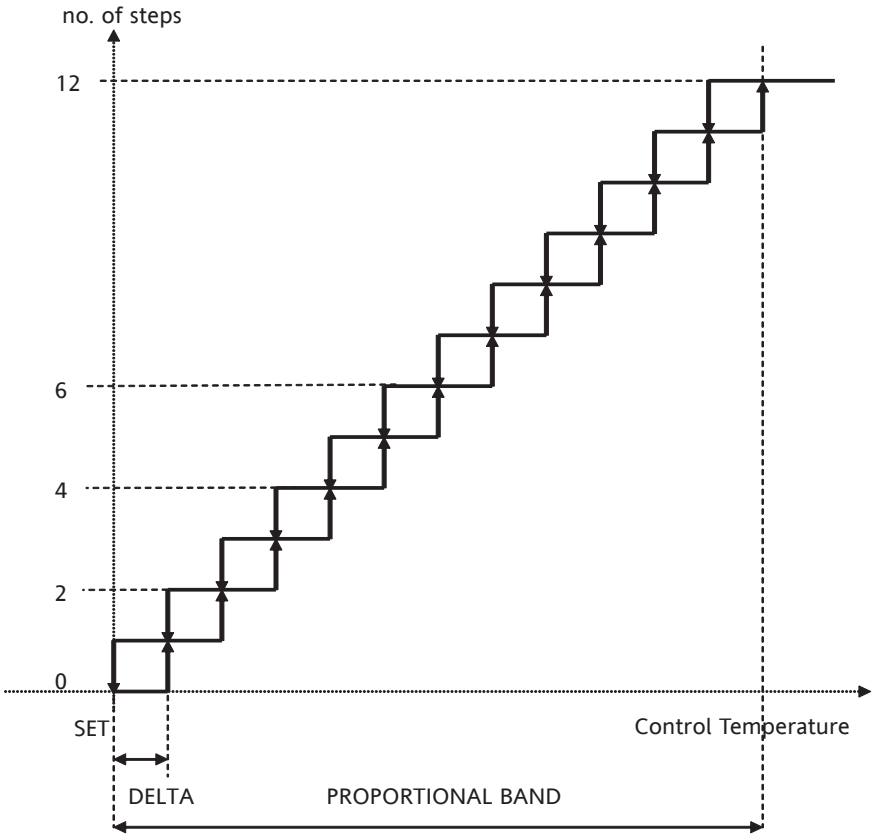
- *Proportional temperature control*
- *PI temperature control*
- *Time proportional*

In all cases the temperature *control* function calculates the number of refrigeration resources (power steps) required by the system though a policy of assigning resources selectable at a level of *evaporator* (EV_SELECTION_FUNCTION), *circuit* (CIR_SELECTION_FUNCTION) and *compressor* (KOMP_SELECTION_FUNCTION).
The time interval for a change in the number of power steps required by the temperature controller is defined by the *parameters* CH_INC_STEP_TIME/CH_DEC_STEP_TIME and HP_INC_STEP_TIME/HP_DEC_STEP_TIME.
In alarm conditions, any reduction in power required is calculated immediately; however, power reinstatement must always comply with the above times, and in particular the time CH_INC_STEP_TIME/ HP_INC_STEP_TIME.

3.1.1 Proportional temperature control

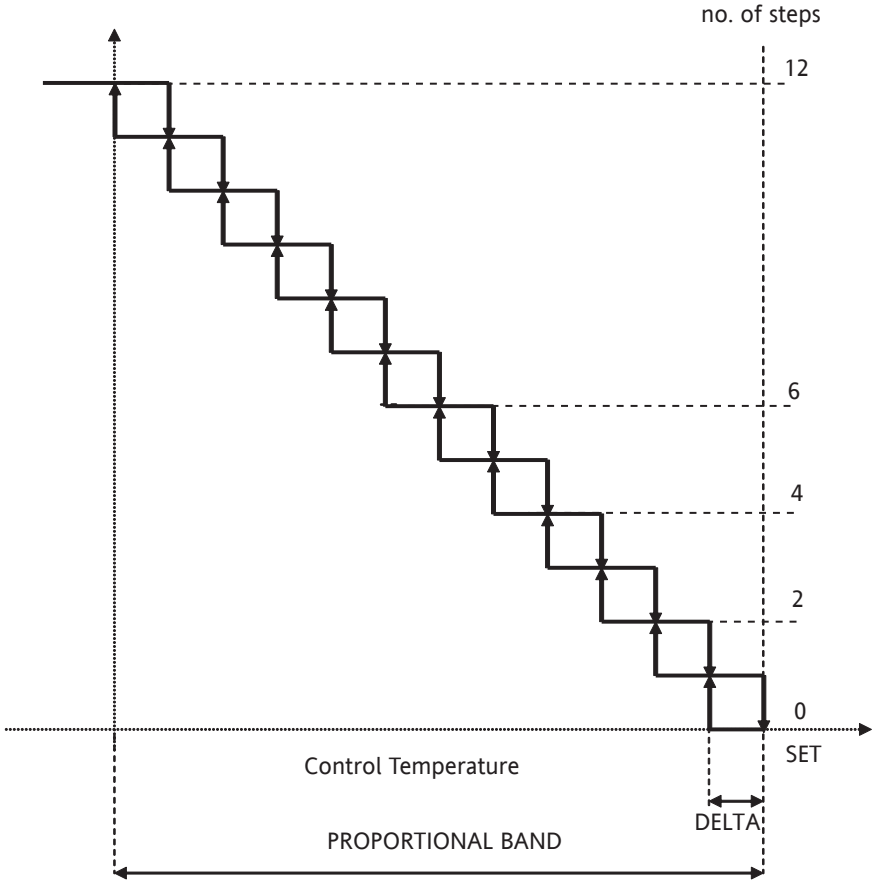
With this type of temperature *control*, a specific number of refrigeration resources (power steps) is activated in order to reach the temperature indicated by the setpoint selected for temperature *control*. Obviously, the number of power steps required to reach the temperature *control* setpoint is directly proportional to the difference between the temperature measured by the sensor and that to be reached (setpoint).
The temperature interval between application of one power step and the next depends on the proportional band (CH_PROP_BAND/HP_PROP_BAND) and the number of resources present. Refer to the following table:

Cooling Mode



SETPOINT:	Temperature *control* setpoint
PROPORTIONAL BAND:	CH_PROP_BAND
DELTA:	CH_PROP_BAND/∑(KOMP_STEP_i +1) (Where i=1... number of compressors)
Control temperature	Temperature measured by temperature *control* sensor
number of steps	[*Control* temperature – SET]/DELTA

Heating Mode



SET:	Temperature *control* setpoint
PROPORTIONAL BAND:	HP_PROP_BAND
DELTA:	HP_PROP_BAND/∑(KOMP_STEP_i +1) (Where i=1... number of compressors)
Control temperature	Temperature measured by temperature *control* sensor
number of steps	[SET-*Control* temperature]/DELTA

3.1.2 PI temperature control

A PID-type continuous controller, and the relevant digital version obtained by DISCRETIZATION of the transfer function, produces a *control* signal which is equal to the sum of three terms:

P(n) proportional to error;
I(n) proportional to the error integral;
D(n) proportional to the error derivative.

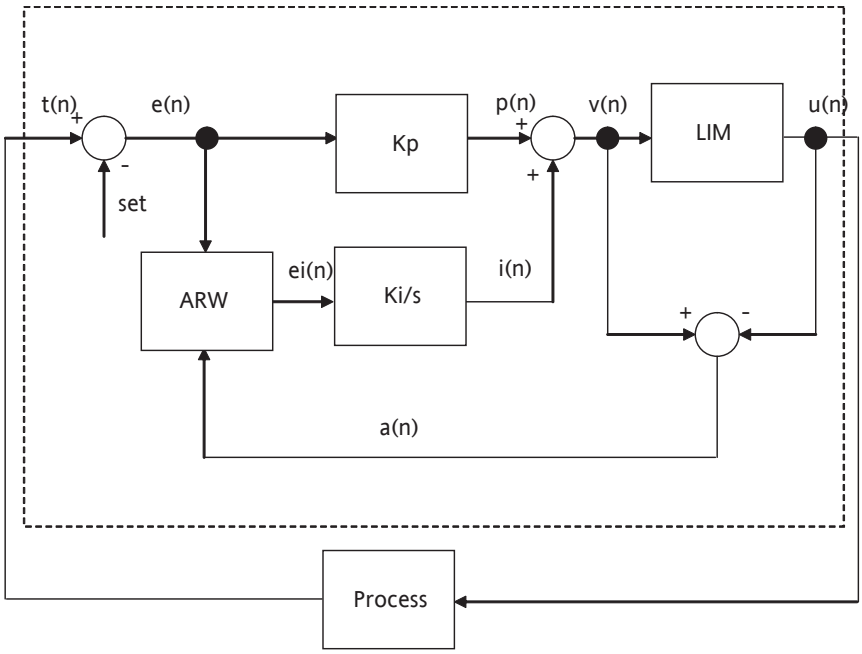
The basic PID controller is characterised by the ideal transfer function between:

input e(t) = ***TemperatureControlSensor***(t) - ***TemperatureControlSetPoint*** in *cooling mode* or ***TemperatureControlSetPoint*** - ***TemperatureControlSensor***(t) in *heating mode*, i.e. the system error, equal to the difference between the process variable measured (in this case the temperature) and the reference signal (***TemperatureControlSetPoint***)
and the *control* signal u(t) applied to the actuator or directly to the process to be controlled.

In this case a PI-type controller can be used; in particular, the following can be set by parameter:

if integral component Ki is to be taken into account (PI_INTEGRAL_COMPONENT_FLAG)
if proportional component Kp is to be taken into account (PI_PROP_COMPONENT_FLAG)
additional time constant Ki
the value of proportional band Bp (CH_PROP_BAND/ HP_PROP_BAND)

The following block diagram shows the P.I. controller implemented, with an explanation of its blocks.



$$u(n) = LIM(v(n)) = LIM (Kp \bullet e(n) + Ki \bullet \sum ei(n)) = LIM(P(n) + I(n))$$

Where:
Kp = 1000/Bp
Ki = Kp•Tc/Ti
Tc ≤ Ti ≤ Timax
u(n) = LIM(v(n)) u(n) = v(n) if 0 < v(n) < 1000
u(n) = 0 if v(n) ≤ 0

u(n) = 1000 if v(n) ≥ 1000

ei(n) = ARW(a(n)) ei(n) = ei(n) if a(n) = 0
ei(n) = 0 if a(n) ≠ 0

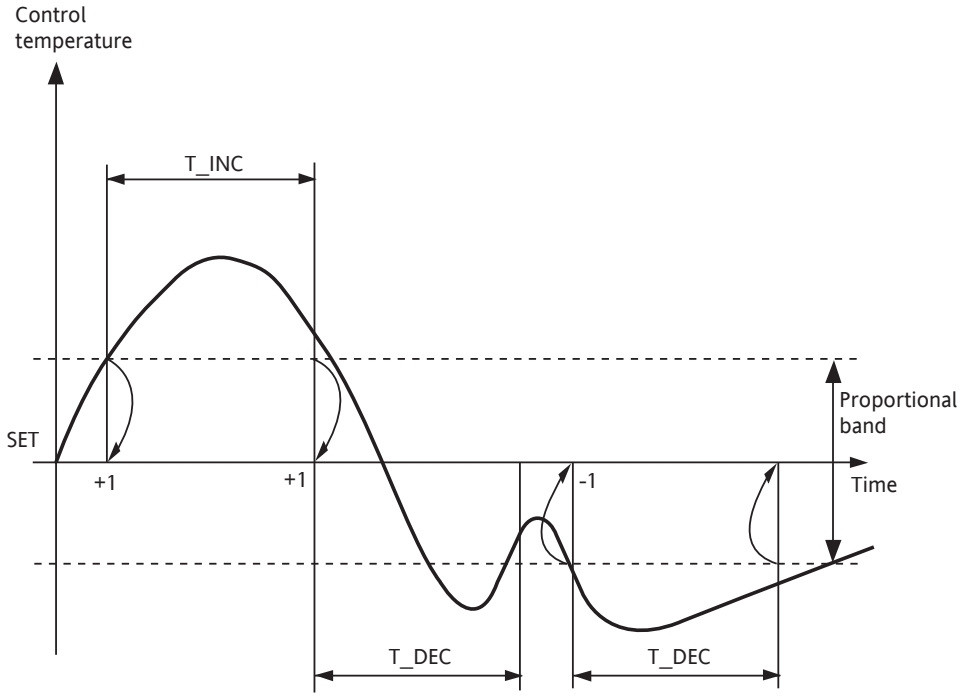
The application has the following correspondence between *parameters* and sensors:

Bp	CH_PROP_BAND/ HP_PROP_BAND
Ti	PI_INTEGRAL_CONSTANT
Timax	Upper limit of PI_INTEGRAL_CONSTANT
Tc	Application cycle time set in ISaGRAF
set	Value of ***TemperatureControlSetPoint***
t(n)	*Control* water temperature measured by the ***TemperatureControlSensor***

3.1.3 Time proportional

Cooling Mode

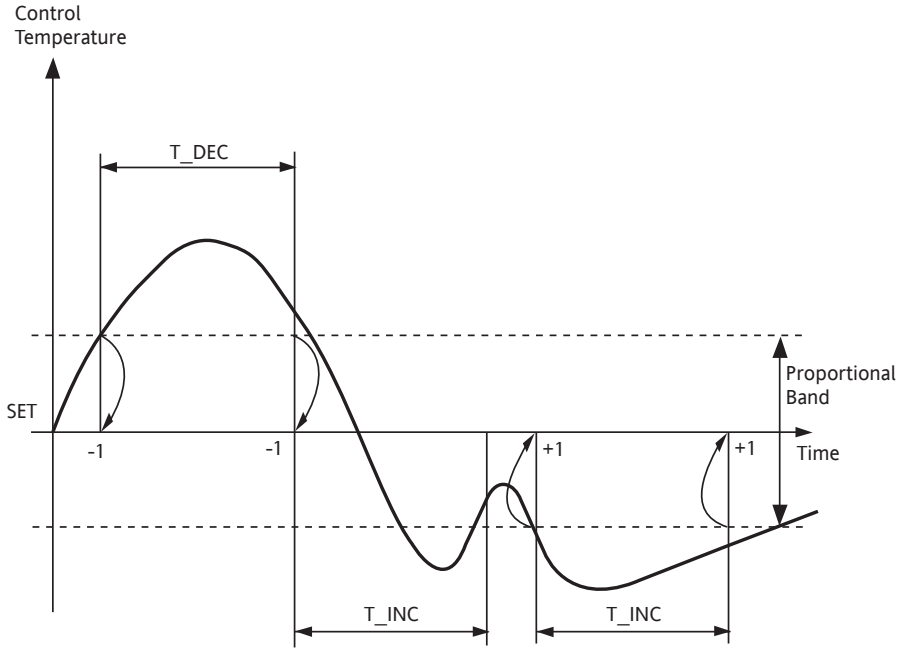
The main function of the temperature controller is that of activating a number of resources (power steps) proportional to the time from when the TemperatureControlSensor has exceeded the threshold *TemperatureControlSetPoint* + (CH_PROP_BAND/2). The proportional band is symmetrical with respect to the *TemperatureControlSetPoint* value.
When the temperature has exceeded the threshold value, a step is immediately effected if the increase interstep time has already elapsed. If the temperature remains above the threshold value, another power step is activated every CH_INC_STEP_TIME seconds. The same operation occurs for switch *off*, with the time settable by parameter CH_DEC_STEP_TIME. In this Algorithm there is no hysteresis.



Control temperature	*TemperatureControl Sensor*
SET	*TemperatureControlSetPoint*
PROPORTIONAL BAND	CH_PROP_BAND
T INC	CH_INC_STEP_TIME
T DEC	CH_DEC_STEP_TIME

Heating Mode

The main function of the temperature controller is that of activating a number of resources (power steps) proportional to the time from when the *TemperatureControl Sensor* has acquired values below the threshold *TemperatureControlSetPoint* - (HP_PROP_BAND/2). The proportional band is symmetrical with respect to the *TemperatureControlSetPoint* value.
When the temperature has fallen below the threshold value, a step is immediately effected if the increase interstep time has already elapsed. If the temperature remains below the threshold value, another power step is activated every HP_INC_STEP_TIME seconds. The same operation occurs for switch *off*, with the time settable by parameter HP_DEC_STEP_TIME. In this Algorithm there is no hysteresis.



Control temperature	*TemperatureControl Sensor*
SET	*TemperatureControlSetPoint*
PROPORTIONAL BAND	HP_PROP_BAND
T INC	HP_INC_STEP_TIME
T DEC	HP_DEC_STEP_TIME

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
260	TREG_FUNCTION	Type of temperature *control* 0=Proportional 1=Time-proportional 2=P.I.	0...2	0	17	C	V	0=PROPORTIONAL, 1=TIME_PROPORTIONAL, 2=PI	num
261	TREG_TEMP_SENS	Selection of sensor for temperature *control*	0...1	0	18	C	V	0=ENTRY_SENSOR 1=EXIT_SENSOR	num
262	PI_INTEGRAL_COMPONENT_FLAG_HOT	Flag used by the proportional component of P.I. temperature controller	0...1	1	6	H	V	0=NO, 1=YES	flag
263	PI_INTEGRAL_CONSTANT_HOT	Integral Time value of the integral component of P.I. temperature controller	1...900	600	0	H	V		sec
264	PI_PROP_COMPONENT_FLAG_HOT	Flag used by the proportional component of P.I. temperature controller	0...1	1	6	H	V	0=NO, 1=YES	flag
270	CH_TSET_TEMP _HOT	Cooling setpoint	CH_MIN_TSET_TEMP... CH_MAX_TSET_TEMP	7.0	0	H	V		°C
271	CH_MIN_TSET_TEMP	Cooling setpoint minimum value	-50.0...80.0	5.0	0	C	V		°C
272	CH_MAX_TSET_TEMP	Cooling setpoint maximum value	-50.0...80.0	25.0	0	C	V		°C
273	CH_ENTRY_OFFSET_HOT	Cooling setpoint offset if temperature *control* is through the primary *circuit* water inlet temperature sensor	0.0...15.0	0.0	0	H	V		°C
274	CH_PROP_BAND_HOT	Cooling proportional band	CH_MIN_PROP_BAND... CH_MAX_PROP_BAND	5.0	0	H	V		°C
275	CH_MIN_PROP_BAND	Minimum value of cooling proportional band	0.0...25.0	0.0	0	C	V		°C
276	CH_MAX_PROP_BAND	Maximum value of cooling proportional band	0.0...25.0	20.0	0	C	V		°C
277	CH_INC_STEP_TIME_HOT	Upward interstep time (cooling power increment)	0...300	10	0	H	V		sec
278	CH_DEC_STEP_TIME_HOT	Downward interstep time (cooling power decrement)	0...300	10	0	H	V		sec
280	HP_TSET_TEMP_HOT	Heating setpoint	HP_MIN_TSET_TEMP... HP_MAX_TSET_TEMP	40.0	0	H	V		°C
281	HP_MIN_TSET_TEMP	Heating setpoint minimum value	-50.0...150.0	30.0	0	C	V		°C
282	HP_MAX_TSET_TEMP	Heating setpoint maximum value	-50.0...150.0	50.0	0	C	V		°C
283	HP_ENTRY_OFFSET_HOT	Heating setpoint offset if temperature *control* is through the primary *circuit* water inlet temperature sensor	0.0...15.0	5.0	0	H	V		°C
284	HP_PROP_BAND_HOT	Heating proportional band	HP_MIN_PROP_BAND... HP_MAX_PROP_BAND	5.0	0	H	V		°C
285	HP_MIN_PROP_BAND	Heating proportional band minimum value	0.0...150.0	5.0	0	C	V		°C
286	HP_MAX_PROP_BAND	Heating proportional band maximum value	0.0...150.0	5.0	0	C	V		°C
287	HP_INC_STEP_TIME_HOT	Upward interstep time (power increments) in *heating mode*	0...300	10	0	H	V		sec
288	HP_DEC_STEP_TIME_HOT	Downward interstep time (power decrements) in *heating mode*	0...300	10	0	H	V		sec

3.2 Pump Down

Pump-down is a particular *circuit* start and stop procedure.
In the stop phase, before switching *off*, the valve (commonly called solenoid valve) on the gas *circuit* before the *evaporator* is closed so that the last *compressor* started, continuing to draw gas from the *evaporator*, causes the gas pressure to fall to the *pump*-down stop value; when it reaches this value the *compressor* switches *off*.
This allows the *evaporator* to be kept practically empty during *compressor* stop times and thus prevent any rise in *evaporator* temperature from bringing the low pressure to values that are too high for the *compressor* and the *evaporator*.

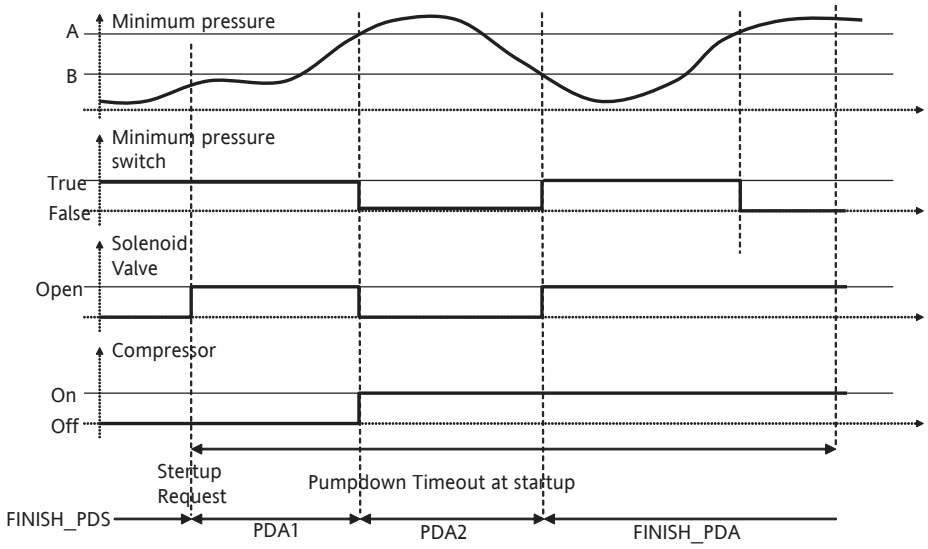
The *pump*-down procedure is controlled by means of a minimum pressure switch.

3.2.1 Pump-down at start

The first *compressor* in a *circuit* must be started as described below, if PD_FUNCTION = ON_START or PD_FUNCTION=FULL:

- The solenoid valve opens. As a result the pressure in the *circuit* starts rising [PDA1].
- When the pressure exceeds the reference value "A", the solenoid valve closes and the *compressor* starts. With a minimum delay, the pressure begins to fall [PDA2].
- When the pressure reaches (or falls below) reference value "B" again, the solenoid valve reopens [FINISH_PDA].

In the example, the activation/deactivation thresholds of the minimum pressure switch correspond to the activation/deactivation values of the solenoid valve controlled by the minimum pressure transducer.



Minimum pressure switch	CIR_PRES_MIN_DI_i_PHY, i=ith *circuit*.
Solenoid valve	CIR_SOLENOID_VALVE_DO_i_PHY, i=ith *circuit*.
Compressor	KOMP_ACC_DO_j_PHY, j=first *compressor* started in the ith *circuit*.
Pump-down timeout at start	PD_OFFON_MAX_TIME.

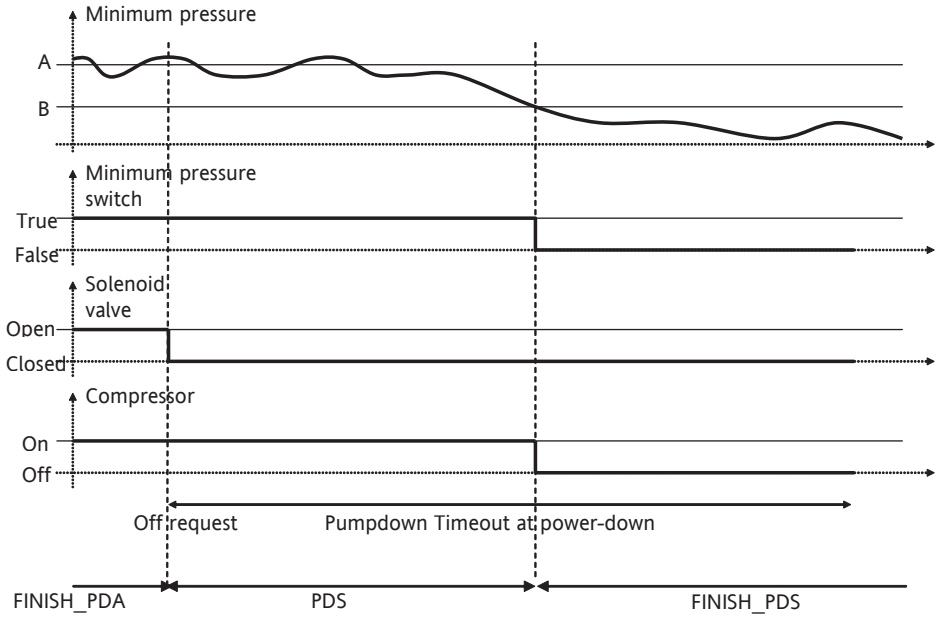
In PDA1 or PDA2, if the *circuit* compressors are not available, the status goes directly to FINISH_PDS with the *circuit* compressors stopped and the solenoid valve closed.
However, if the *pump-down timeout* of the start phase expires in PDA1 or PDA2, the status goes directly to FINISH_PDA with the compressors controlled by the temperature controller and the solenoid valve open. In this case, only an alarm signal non-blocking for the machine is given, provided PD_A_MAXTIME_ENABLE_FLAG=YES. The alarm is reset as soon as a *pump*-down sequence (in start or going *off*) has been completed correctly. In any case, the alarm is reset when exiting configuration mode and in system switch on/switch *off*.

If there is a *circuit*-blocking alarm while *pump*-down is active, the *pump*-down sequence is stopped and the solenoid valve closed, unless a minimum pressure alarm is present (in this case the valve is open).

3.2.2 Pump-down in going off

The last *compressor* in a *circuit* must be switched *off* as follows, if PD_FUNCTION=FULL:

- The solenoid valve closes. As a result, the pressure starts to fall [PDS]
- When the pressure in the *circuit* falls below reference value B, the *compressor* switches *off* [FINISH_PDS]



Minimum pressure switch	CIR_PRES_MIN_D_i_PHY, i=ith *circuit*.
Solenoid valve	CIR_SOLENOID_VALVE_DO_i_PHY, i=ith *circuit*.
Compressor	KOMP_ACC_DO_j_PHY, j=first *compressor* started in the ith *circuit*.
Pump-down timeout at start	PD_ONOFF_MAX_TIME.

In PDS, if the *circuit* compressors are not available, or the *pump-down timeout* expires in going *off*, the status goes directly to FINISH_PDS with the *circuit* compressors *off* and the solenoid valve closed. If the *pump-down timeout* expires in going *off*, only an alarm signal non-blocking for the machine is given, provided PD_A_MAXTIME_ENABLE_FLAG=YES.
The alarm is reset as soon as a *pump*-down sequence (in start or going *off*) has been completed correctly. In any case, the alarm is reset when exiting configuration mode and in system switch on/switch *off*

If there is a *circuit*-blocking alarm while *pump*-down is active, the *pump*-down sequence is stopped and the solenoid valve closed, unless a minimum pressure alarm is present (in this case the valve is open)

3.2.3 Pump-down timeout

If PD_A_MAXTIME_ENABLE_FLAG=YES and the *pump*-down procedure in start (phases PDA1 and PDA2) does not end within the time PD_OFFON_MAX_TIME only a *pump-down timeout* signal without blocking *circuit* resources is given.
If PD_A_MAXTIME_ENABLE_FLAG=YES and the *pump*-down procedure in switch *off* (phase PDS) does not end within the time PD_OFFON_MAX_TIME only a *pump-down timeout* signal without blocking *circuit* resources is given.
The alarm is reset as soon as a *pump*-down sequence (in start or going *off*) has been completed correctly. In any case, the alarm is reset when exiting configuration mode and in system switch on/switch *off*

3.2.4 Solenoid valve management

Solenoid valve	CIR_SOLENOID_VALVE_DO_i_PHY, i=ith *circuit*.

If *pump*-down is not enabled (PD_FUNCTION = PD_NONE) for all circuits, the solenoid valve is always open.

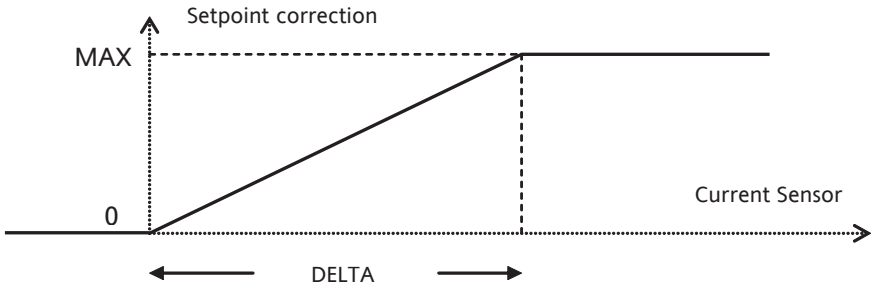
If enabled, the solenoid valve is open only during phases PDA1 and FINISH_PDA for circuits where the *pump*-down procedure is in progress. If there is an alarm that blocks the *circuit*, or the compressors belonging to the *circuit* are not available, the solenoid valve is closed, except if there is a minimum pressure alarm in the *circuit* that is keeping the valve open.

Note: The solenoid valve is open when the corresponding relay is not energised and closed when it is energised

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
490	PD_FUNCTION	Selection of type of *pump*-down: not active (NO_PD), at start (ON_START), or at start and going *off* (FULL)	0...2	2	15	C	V	0=NO_PD, 1=ON_START, 2=FULL	num
491	PD_OFFON_MAX_TIME	Maximum *pump*-down time at start	0...1800	10	0	C	V		sec
492	PD_ONOFF_MAX_TIME	Maximum *pump*-down time in going *off*	0...1800	10	0	C	V		sec
493	PD_A_MAXTIME_ENABLE_FLAG	Enable *pump-down timeout* alarms	0...1	1	6	C	V	0=NO, 1=YES	flag

3.3 Dynamic setpoint

The *dynamic setpoint* function allows the setpoint to be modified in automatic mode according to a given input signal on the controller.



DELTA	300
MAX	DTSET_*CHILLER*_MAX_OFFSET/ DTSET_HEATPUMP_MAX_OFFSET
Current sensor	PLAN_CURR_DTSET_SENS
Setpoint correction	(Current sensor * MAX) / DELTA;

The correction to Setpoint is added with sign to the current value of the temperature *control* setpoint.

If one of the following conditions occurs *:*

- Function disabled (DTSET_FUNCTION <> CURRENT_FUNCTION);
- Current sensor error;

The setpoint correction is always 0.

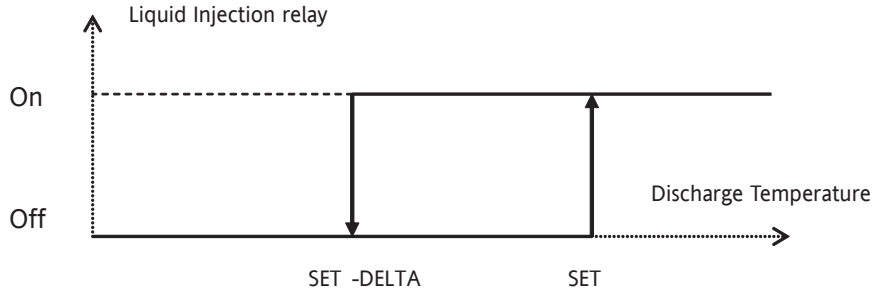
If none of the above conditions occurs, the setpoint correction is controlled by the function described in the above chart. Setting the parameter DTSET_*CHILLER*_MAX_OFFSET/ DTSET_HEATPUMP_MAX_OFFSET to a negative value causes rotation of the trend illustrated around the horizontal axis.

Note: The Current sensor PLAN_CURR_DTSET_SENS_PHY must be configured in the BIOS with value at 4mA equal to 0.0 Bar and value at 20mA equal to 30.0 Bar. This is necessary so that the current sensor works in ISaGRAF within the conversion range 0-300

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
2A0	DTSET_FUNCTION	Enable *dynamic setpoint* function 0=not enabled or none 1=in temperature (not supported) 2=in current	0..2	2	19	C	V	0=NO_PD, 1=ON_START, 2=FULL	num
2A1	DTSET_*CHILLER*_MAX_OFFSET	Maximum offset value that the *dynamic setpoint* can add to the cooling setpoint	-30.0...30.0	6.0	0	C	V		°C
2A2	DTSET_HEATPUMP_MAX_OFFSET	Maximum offset value that the *dynamic setpoint* can add to the heating setpoint	-30.0...30.0	5.0	0	C	V		°C

3.4 Compressor liquid injection

One relay is allocated and controlled for each *compressor*, for the liquid injection function.



SET	LI_TSET_TEMP
DELTA	LI_DELTA_TEMP
Discharge temperature	KOMP_TEMP_DISCHARGE_SENS_i_PHY, i = ith *compressor*
Liquid injection relay	KOMP_IL_DO_i_PHY, i = ith *compressor*

If one of the following conditions occurs *:*

- Function disabled (LI_ENABLE_FLAG=false);
- Discharge temperature error;
- *Compressor* alarm;
- System *Off*;
- *Compressor* deselected.

The liquid injection relay is remains *Off*.

If none of the above conditions occurs, the status of the liquid injection relay is controlled by the hysteresis function described in the above chart.
In particular, the liquid injection relay is On if Discharge temperature >=SET, *Off* if Discharge temperature <(SET-DELTA), and unchanged in the other cases.

The hysteresis function is set to *Off* in the following cases*:*

- System start or switch *off*;
- exit from configuration mode;
- by reset.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
310	LI_ENABLE_FLAG	Enable liquid injection function	0...1	1	6	C	V	0=NO 1=YES	flag
311	LI_TSET_TEMP	Setpoint for liquid injection function	0.0...150.0	115.0	0	C	V		°C
312	LI_DELTA_TEMP	Liquid injection delta function	0.0...10.0	10.0	0	C	V		°C

3.5 Compressor Swap

The Swap function is useful for optimising the life-cycle of the compressors. This function automatically determines which *compressor* to use in a *circuit* according to the total number of hours of operation.
This function is useful for balancing the oil in the *circuit* and for balancing the *hours of compressor use*.
The parameter determining if the Swap function is active is parameter KOMP_SWAP_ENABLE_FLAG.
The *parameters* that fix the time limit for activation of the swap are SINGLE_KOMP_ON_MAX_TIME_HOT and SINGLE_KOMP_*OFF*_MIN_TIME_HOT.

3.5.1 Enabling

The Swap can occur between two compressors of the same *circuit* if the following conditions exist*:*

- KOMP_SWAP_ENABLE_FLAG=YES;
- No alarm must be active in the *circuit*;
- No alarm for the system or the *circuit evaporator* must be active;
- The machine must not be *off* or going *off*;
- *Defrost* in the *circuit* must not be in progress;
- The *pump-down at start* in the *circuit* must be over if PD_FUNCTION<>0;
- The *circuit* must comprise at least two compressors.

If, in the above conditions, there is a *compressor* in a *circuit* of the system *:*

- operating for more than the time SINGLE_KOMP_ON_MAX_TIME_HOT;

and a *compressor:*

- in *Off* status for more than the time SINGLE_KOMP_*OFF*_MIN_TIME_HOT;
- having a number of steps available at least equal to that of the *compressor* selected for switch *off*;
- not deselected;
- that has not exceeded the maximum number of hourly activations.

the two compressors carry out a swap, i.e. the first switches *Off* and the second switches On.

The choice of *compressor* to be switched *off*, if several compressors in the same *circuit* meet the above-mentioned requirements, is made according to the highest number of hours of operation.
The choice of *compressor* to be switched on, if several compressors in the same *circuit* meet the above-mentioned requirements, is made according to the lowest number of hours of operation.

The swap cannot occur at the same time on more than one *circuit*; if several circuits have swap activation conditions, the swap will be activated initially on the lower value *circuit* and then on the others. If the swap is in progress, one of the following conditions disables it*:*

- Activation of an alarm in the *circuit*;
- Activation of an alarm in the system or for the *circuit evaporator*;
- Machine switch *off*;
- Activation of an alarm for one of the compressors of the swap *circuit*;
- Deselection of a *compressor* in operation for the swap *circuit*.

Note: If the swap is in progress, a possible demand for *defrost* in the *circuit* will remain pending until the end of the swap.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
2F9	KOMP_SWAP_ENABLE_FLAG	Enable *compressor swap* function	0...1	1	6	C	V	0=NO 1=YES	flag
2FA	SINGLE_KOMP_ON_MAX_TIME_HOT	*Compressor* maximum continuous On time to enable swapping	0...300	100	0	H	V		Hour
2FB	SINGLE_KOMP_*OFF*_MIN_TIME_HOT	*Compressor* minimum *Off* time to enable swapping	0...300	100	0	H	V		Hour

3.6 Time band management

Up to 4 individually enabled time bands can be set for every day of the week, within which the system automatically selects the *control* mode and corresponding setpoint.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Band 1	Start (hours and minutes)						
Band 2	*Enabling*						
Band 3	Heating Set/Cooling Set						
Band 4	Mode						

To enable *time band management* the parameter TIME_BAND_ENABLE_FLAG_HOT must be set to YES.
The RTC must be present and function correctly.
Three types of time bands can be selected:

- Daily: it has an individual programming every day;
- Weekly: every day of the week has the same setting;
- "5+2": the settings are the same from Monday to Friday and from Saturday to Sunday;

Selection is made by means of the parameter TIME_BAND_TYPE [0=Daily,1=Weekly, 2=5+2].

Time band programming always has priority over the setting from remote *control* or keypad except for the digital input PLAN_ONOFF_DI_PHY (remote ON/*OFF*) which, if enabled by the parameter PLAN_ONOFF_DI_ENABLE_FLAG, in any case has priority in determining system status.
In particular, if the input is enabled and active the machine will always be *off* and *time band management* disabled while the machine remains *off*. *Time band management* is disabled even if configuration mode is activated.

Note: If TIME_BAND_ENABLE_FLAG_HOT=YES, on exiting configuration mode or when PLAN_ONOFF_DI_PHY goes from true-> false with PLAN_ONOFF_DI_ENABLE_FLAG=YES or if PLAN_ONOFF_DI_ENABLE_FLAG goes to NO, *time band management* is immediately reactivated.

3.6.1 Time band start

The start time, expressed in hours and minutes, can be determined for every time band.
Although there are no limits in programming values, for correct initialisation of the function, the times of the events must be set in ascending order. In case of 2 or more events programmed in the same time, only the first will be considered.

3.6.2 Time band enabling

Each individual time band can enabled or disabled independently of the settings.

3.6.3 Time band Setpoint

When *time band management* is enabled and the mode set is HEATING, COOLING or *MANUAL MODE* the *control* setpoint is that set in the active band.
With *OFF* mode or *LOCAL SET* or when *time band management* is not enabled, the setpoint value is reset with the original value (CH_TSET_TEMP_HOT or HP_TSET_TEMP_HOT).

3.6.4 Time Band Mode

One operating mode can be selected for each time band.
The possible modes are:

- *OFF*
- *PUMP*
- *CHILLER*
- *MANUAL MODE*
- *LOCAL SET*

3.6.4.1 OFF

In this band the machine is always *off* in any case.

3.6.4.2 PUMP

In this band the machine is on in *pump* mode independently of the digital input PLAN_MODE_DI_PHY (summer/winter switchover) and the parameter PLAN_MODE_MANUAL_HOT (*manual mode* selection).
The *control* setpoint is that set inside the current band.

3.6.4.3 CHILLER

In this band the machine is on in *chiller* mode independently of the digital input PLAN_MODE_DI_PHY (summer/winter switchover) and the parameter PLAN_MODE_MANUAL_HOT (*manual mode* selection).
The *control* setpoint is that set inside the current band.

3.6.4.4 MANUAL MODE

In this band the machine is on and operating mode selection is determined by the digital input PLAN_MODE_DI_PHY if enabled (summer/winter switchover) or, alternatively, by the parameter PLAN_MODE_MANUAL_HOT (*manual mode* selection).
The *control* setpoint is that set inside the current band.

3.6.4.5 LOCAL SET

In this band the machine is on and operating mode selection is determined by the digital input PLAN_MODE_DI_PHY if enabled (summer/winter switchover) or, alternatively, by the parameter PLAN_MODE_MANUAL_HOT (*manual mode* selection).
The *control* setpoint takes the original value (CH_TSET_TEMP_HOT or HP_TSET_TEMP_HOT) according to the active operating mode.

Note
The mode change procedure always occurs by switching off the machine, respecting all the safety times and switching it on again after setting the new operating mode value.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
7F0	TIME_BAND_ENABLE_FLAG_HOT	Enable *time band management*	0...1	1	6	H	V	0=NO, 1=YES	flag
7F1	TIME_BAND_TYPE	*Time band mode*	0...2	0	0	C	V	0=Daily,1=Weekly, 2=5+2	Num
7F2	TIME_1_BAND1_ENABLE_FLAG	enable band 1 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7F3	TIME_1_BAND1_HOUR	hour start of band 1 LUN/5D/SETT	0...23	0	0	C	V		Hour
7F4	TIME_1_BAND1_MIN	band start minutes 1 LUN/5D/SETT	0...59	0	0	C	V		Min
7F5	TIME_1_BAND1_MODE_HOT	operating mode 1 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
7F6	TIME_1_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7F7	TIME_1_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7F8	TIME_1_BAND2_ENABLE_FLAG	enable band 2 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7F9	TIME_1_BAND2_HOUR	hour start of band 2 LUN/5D/SETT	0...23	6	0	C	V		Hour
7FA	TIME_1_BAND2_MIN	minutes start of band 2 LUN/5D/SETT	0...59	0	0	C	V		Min
7FB	TIME_1_BAND2_MODE_HOT	operating mode 2 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
7FC	TIME_1_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7FD	TIME_1_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7FE	TIME_1_BAND3_ENABLE_FLAG	enable band 3 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7FF	TIME_1_BAND3_HOUR	hour start of band 3 LUN/5D/SETT	0...23	12	0	C	V		Hour
800	TIME_1_BAND3_MIN	minutes start of band 3 LUN/5D/SETT	0...59	0	0	C	V		Min
801	TIME_1_BAND3_MODE_HOT	operating mode 3 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
802	TIME_1_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
803	TIME_1_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
804	TIME_1_BAND4_ENABLE_FLAG	enable band 4 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
805	TIME_1_BAND4_HOUR	hour start of band 4 LUN/5D/SETT	0...23	18	0	C	V		Hour
806	TIME_1_BAND4_MIN	minutes start of band 4 LUN/5D/SETT	0...59	0	0	C	V		Min
807	TIME_1_BAND4_MODE_HOT	operating mode 4 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
808	TIME_1_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
809	TIME_1_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
80A	TIME_2_BAND1_ENABLE_FLAG	enable band 1 MAR/2D	0...1	1	6	C	V	0=NO, 1=YES	flag
80B	TIME_2_BAND1_HOUR	hour start of band 1 MAR /2D	0...23	0	0	C	V		Hour
80C	TIME_2_BAND1_MIN	minutes start of band 1 MAR /2D	0...59	0	0	C	V		Min
80D	TIME_2_BAND1_MODE_HOT	operating mode 1 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
80E	TIME_2_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
80F	TIME_2_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
810	TIME_2_BAND2_ENABLE_FLAG	enable band 2 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
811	TIME_2_BAND2_HOUR	hour start of band 2 MAR /2D	0...23	6	0	C	V		Hour
812	TIME_2_BAND2_MIN	minutes start of band 2 MAR /2D	0...59	0	0	C	V		Min
813	TIME_2_BAND2_MODE_HOT	operating mode 2 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
814	TIME_2_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
815	TIME_2_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
816	TIME_2_BAND3_ENABLE_FLAG	enable band 3 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
817	TIME_2_BAND3_HOUR	hour start of band 3 MAR /2D	0...23	12	0	C	V		Hour
818	TIME_2_BAND3_MIN	minutes start of band 3 MAR /2D	0...59	0	0	C	V		Min
819	TIME_2_BAND3_MODE_HOT	operating mode 3 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
81A	TIME_2_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
81B	TIME_2_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
81C	TIME_2_BAND4_ENABLE_FLAG	enable band 4 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
81D	TIME_2_BAND4_HOUR	hour start of band 4 MAR /2D	0...23	18	0	C	V		Hour
81E	TIME_2_BAND4_MIN	minutes start of band 4 MAR /2D	0...59	0	0	C	V		Min
81F	TIME_2_BAND4_MODE_HOT	operating mode 4 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
820	TIME_2_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
821	TIME_2_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
822	TIME_3_BAND1_ENABLE_FLAG	enable band 1 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
823	TIME_3_BAND1_HOUR	hour start of band 1 MER	0...23	0	0	C	V		Hour

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
824	TIME_3_BAND1_MIN	minutes for start of band 1 MER	0...59	0	0	C	V		Min
825	TIME_3_BAND1_MODE_HOT	operating mode 1 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
826	TIME_3_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 MER	-50.0...150.0	12.0	0	H	V		°C
827	TIME_3_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 MER	-50.0...150.0	40.0	0	H	V		°C
828	TIME_3_BAND2_ENABLE_FLAG	enable band 2 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
829	TIME_3_BAND2_HOUR	hour start of band 2 MER	0...23	6	0	C	V		Hour
82A	TIME_3_BAND2_MIN	minutes start of band 2 MER	0...59	0	0	C	V		Min
82B	TIME_3_BAND2_MODE_HOT	operating mode 2 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
82C	TIME_3_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 MER	-50.0...150.0	12.0	0	H	V		°C
82D	TIME_3_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 MER	-50.0...150.0	40.0	0	H	V		°C
82E	TIME_3_BAND3_ENABLE_FLAG	enable band 3 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
82F	TIME_3_BAND3_HOUR	hour start of band 3 MER	0...23	12	0	C	V		Hour
830	TIME_3_BAND3_MIN	minutes start of band 3 MER	0...59	0	0	C	V		Min
831	TIME_3_BAND3_MODE_HOT	operating mode 3 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
832	TIME_3_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 MER	-50.0...150.0	12.0	0	H	V		°C
833	TIME_3_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 MER	-50.0...150.0	40.0	0	H	V		°C
834	TIME_3_BAND4_ENABLE_FLAG	enable band 4 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
835	TIME_3_BAND4_HOUR	hour start of band 4 MER	0...23	18	0	C	V		Hour
836	TIME_3_BAND4_MIN	hour start of band 4 MER	0...59	0	0	C	V		Min
837	TIME_3_BAND4_MODE_HOT	operating mode 4 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
838	TIME_3_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 MER	-50.0...150.0	12.0	0	H	V		°C
839	TIME_3_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 MER	-50.0...150.0	40.0	0	H	V		°C
83A	TIME_4_BAND1_ENABLE_FLAG	enable band 1 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
83B	TIME_4_BAND1_HOUR	hour start of band 1 GIO	0...23	0	0	C	V		Hour
83C	TIME_4_BAND1_MIN	minutes start of band 1 GIO	0...59	0	0	C	V		Min
83D	TIME_4_BAND1_MODE_HOT	operating mode 1 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP*	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
								2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	
83E	TIME_4_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 GIO	-50.0...150.0	12.0	0	H	V		°C
83F	TIME_4_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 GIO	-50.0...150.0	40.0	0	H	V		°C
840	TIME_4_BAND2_ENABLE_FLAG	enable band 2 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
841	TIME_4_BAND2_HOUR	hour start of band 2 GIO	0...23	6	0	C	V		Hour
842	TIME_4_BAND2_MIN	minutes start of band 2 GIO	0...59	0	0	C	V		Min
843	TIME_4_BAND2_MODE_HOT	operating mode 2 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
844	TIME_4_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 GIO	-50.0...150.0	12.0	0	H	V		°C
845	TIME_4_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 GIO	-50.0...150.0	40.0	0	H	V		°C
846	TIME_4_BAND3_ENABLE_FLAG	enable band 3 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
847	TIME_4_BAND3_HOUR	hour start of band 3 GIO	0...23	12	0	C	V		Hour
848	TIME_4_BAND3_MIN	minutes start of band 3 GIO	0...59	0	0	C	V		Min
849	TIME_4_BAND3_MODE_HOT	operating mode 3 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
84A	TIME_4_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 GIO	-50.0...150.0	12.0	0	H	V		°C
84B	TIME_4_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 GIO	-50.0...150.0	40.0	0	H	V		°C
84C	TIME_4_BAND4_ENABLE_FLAG	enable band 4 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
84D	TIME_4_BAND4_HOUR	hour start of band 4 GIO	0...23	18	0	C	V		Hour
84E	TIME_4_BAND4_MIN	minutes start of band 4 GIO	0...59	0	0	C	V		Min
84F	TIME_4_BAND4_MODE_HOT	operating mode 4 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
850	TIME_4_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 GIO	-50.0...150.0	12.0	0	H	V		°C
851	TIME_4_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 GIO	-50.0...150.0	40.0	0	H	V		°C
852	TIME_5_BAND1_ENABLE_FLAG	enable band 1 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
853	TIME_5_BAND1_HOUR	hour start of band 1 VEN	0...23	0	0	C	V		Hour
854	TIME_5_BAND1_MIN	minutes start of band 1 VEN	0...59	0	0	C	V		Min
855	TIME_5_BAND1_MODE_HOT	operating mode 1 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
856	TIME_5_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 VEN	-50.0...150.0	12.0	0	H	V		°C
857	TIME_5_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 VEN	-50.0...150.0	40.0	0	H	V		°C
858	TIME_5_BAND2_ENABLE_FLAG	enable band 2 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
859	TIME_5_BAND2_HOUR	hour start of band 2 VEN	0...23	6	0	C	V		Hour
85A	TIME_5_BAND2_MIN	minutes start of band 2 VEN	0...59	0	0	C	V		Min
85B	TIME_5_BAND2_MODE_HOT	operating mode 2 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
85C	TIME_5_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 VEN	-50.0...150.0	12.0	0	H	V		°C
85D	TIME_5_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 VEN	-50.0...150.0	40.0	0	H	V		°C
85E	TIME_5_BAND3_ENABLE_FLAG	enable band 3 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
85F	TIME_5_BAND3_HOUR	hour start of band 3 VEN	0...23	12	0	C	V		Hour
860	TIME_5_BAND3_MIN	minutes start of band 3 VEN	0...59	0	0	C	V		Min
861	TIME_5_BAND3_MODE_HOT	operating mode 3 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
862	TIME_5_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 VEN	-50.0...150.0	12.0	0	H	V		°C
863	TIME_5_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 VEN	-50.0...150.0	40.0	0	H	V		°C
864	TIME_5_BAND4_ENABLE_FLAG	enable band 4 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
865	TIME_5_BAND4_HOUR	hour start of band 4 VEN	0...23	18	0	C	V		Hour
866	TIME_5_BAND4_MIN	minutes start of band 4 VEN	0...59	0	0	C	V		Min
867	TIME_5_BAND4_MODE_HOT	operating mode 4 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
868	TIME_5_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 VEN	-50.0...150.0	12.0	0	H	V		°C
869	TIME_5_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 VEN	-50.0...150.0	40.0	0	H	V		°C
86A	TIME_6_BAND1_ENABLE_FLAG	enable band 1 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
86B	TIME_6_BAND1_HOUR	hour start of band 1 SAB	0...23	0	0	C	V		Hour
86C	TIME_6_BAND1_MIN	minutes start of band 1 SAB	0...59	0	0	C	V		Min
86D	TIME_6_BAND1_MODE_HOT	operating mode 1 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
86E	TIME_6_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 SAB	-50.0...150.0	12.0	0	H	V		°C
86F	TIME_6_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 SAB	-50.0...150.0	40.0	0	H	V		°C
870	TIME_6_BAND2_ENABLE_FLAG	enable band 2 SAB	0...1	1	6	C	V	0=NO,	flag

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
								1=YES	
871	TIME_6_BAND2_HOUR	hour start of band 2 SAB	0...23	6	0	C	V		Hour
872	TIME_6_BAND2_MIN	minutes start of band 2 SAB	0...59	0	0	C	V		Min
873	TIME_6_BAND2_MODE_HOT	operating mode 2 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
874	TIME_6_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 SAB	-50.0...150.0	12.0	0	H	V		°C
875	TIME_6_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 SAB	-50.0...150.0	40.0	0	H	V		°C
876	TIME_6_BAND3_ENABLE_FLAG	enable band 3 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
877	TIME_6_BAND3_HOUR	hour start of band 3 SAB	0...23	12	0	C	V		Hour
878	TIME_6_BAND3_MIN	minutes start of band 3 SAB	0...59	0	0	C	V		Min
879	TIME_6_BAND3_MODE_HOT	operating mode 3 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
87A	TIME_6_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 SAB	-50.0...150.0	12.0	0	H	V		°C
87B	TIME_6_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 SAB	-50.0...150.0	40.0	0	H	V		°C
87C	TIME_6_BAND4_ENABLE_FLAG	enable band 4 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
87D	TIME_6_BAND4_HOUR	hour start of band 4 SAB	0...23	18	0	C	V		Hour
87E	TIME_6_BAND4_MIN	minutes start of band 4 SAB	0...59	0	0	C	V		Min
87F	TIME_6_BAND4_MODE_HOT	operating mode 4 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
880	TIME_6_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 SAB	-50.0...150.0	12.0	0	H	V		°C
881	TIME_6_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 SAB	-50.0...150.0	40.0	0	H	V		°C
882	TIME_7_BAND1_ENABLE_FLAG	enable band 1 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
883	TIME_7_BAND1_HOUR	hour start of band 1 DOM	0...23	0	0	C	V		Hour
884	TIME_7_BAND1_MIN	minutes start of band 1 DOM	0...59	0	0	C	V		Min
885	TIME_7_BAND1_MODE_HOT	operating mode 1 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
886	TIME_7_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 DOM	-50.0...150.0	12.0	0	H	V		°C
887	TIME_7_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 DOM	-50.0...150.0	40.0	0	H	V		°C
888	TIME_7_BAND2_ENABLE_FLAG	enable band 2 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
889	TIME_7_BAND2_HOUR	hour start of band 2 DOM	0...23	6	0	C	V		Hour
88A	TIME_7_BAND2_MIN	minutes start of band 2 DOM	0...59	0	0	C	V		Min

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
88B	TIME_7_BAND2_MODE_HOT	operating mode 2 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
88C	TIME_7_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 DOM	-50.0...150.0	12.0	0	H	V		°C
88D	TIME_7_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 DOM	-50.0...150.0	40.0	0	H	V		°C
88E	TIME_7_BAND3_ENABLE_FLAG	enable band 3 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
88F	TIME_7_BAND3_HOUR	hour start of band 3 DOM	0...23	12	0	C	V		Hour
890	TIME_7_BAND3_MIN	minutes start of band 3 DOM	0...59	0	0	C	V		Min
891	TIME_7_BAND3_MODE_HOT	operating mode 3 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
892	TIME_7_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 DOM	-50.0...150.0	12.0	0	H	V		°C
893	TIME_7_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 DOM	-50.0...150.0	40.0	0	H	V		°C
894	TIME_7_BAND4_ENABLE_FLAG	enable band 4 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
895	TIME_7_BAND4_HOUR	hour start of band 4 DOM	0...23	18	0	C	V		Hour
896	TIME_7_BAND4_MIN	minutes start of band 4 DOM	0...59	0	0	C	V		Min
897	TIME_7_BAND4_MODE_HOT	operating mode 4 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
898	TIME_7_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 DOM	-50.0...150.0	12.0	0	H	V		°C
899	TIME_7_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 DOM	-50.0...150.0	40.0	0	H	V		°C

3.7 Condensation control

In this system the *fans* are grouped into a max. of 2 fan batteries, which *control* the condensation in different circuits. Each *circuit* has its own maximum pressure sensor, temperature sensor on the condenser and its own operating dynamics, whereas ventilation is controlled by all circuits belonging to the same fan battery.

To establish which circuits belong to a fan battery, it is necessary to set the *parameters* CIR_*FANS*_i, i =ith *circuit*.
For example, for the default machine, the set parameter values are those given in the following table:

CIR_*FANS*_1	1	CIR_*FANS*_5	0
CIR_*FANS*_2	1	CIR_*FANS*_6	0
CIR_*FANS*_3	2	CIR_*FANS*_7	0
CIR_*FANS*_4	2	CIR_*FANS*_8	0

This corresponds to a total of 2 fan batteries, the first comprises circuits 1 and 2, and the second circuits 3 and 4.

IMPORTANT NOTE: The table must be completed from top to bottom with values strictly in ascending order.

When the system is not *off*, the fan batteries *fans* are set to the maximum (in *Chiller* mode)/minimum (in *Pump* mode) ventilation requirements of each individual fan battery *circuit*. *Control* can occur in pressure (*FANS_CONTROL*_INPUT_SOURCE=Pressure) and temperature (*FANS_CONTROL*_INPUT_SOURCE= Temperature).
If there is an error in one of the sensors, its value is not taken into account in calculating the maximum/minimum. If, however, there is an error in all the sensors, the *fans* are always switched *off* unless they are still in pick-up, i.e. when the *fans* are still forced at full power (*FANS*_CH_INIT_MAX_POWER_TIME/ *FANS*_HP_INIT_MAX_POWER_TIME).

The *fans* are always stopped when the system is *off*.

A single fan thermal protection input is provided per fan battery irrespective of the number of *fans* in each battery. Tripping of the fan battery thermal protection causes immediate stop.

The fan *control* is digital (ON/*OFF control* in steps) or continuous (by means of analogue outputs, one per fan battery). The parameter used to select the *control* mode (digital or continuous) is *FANS_CONTROL*_FUNCTION.

The *fans* can be activated:

- independently of compressors status;
- if at least one *compressor* in the *circuit* belonging to the fan battery is on;

Selection can be made by suitably setting the parameter *FANS*_KOMP_DEPENDENCY_FLAG

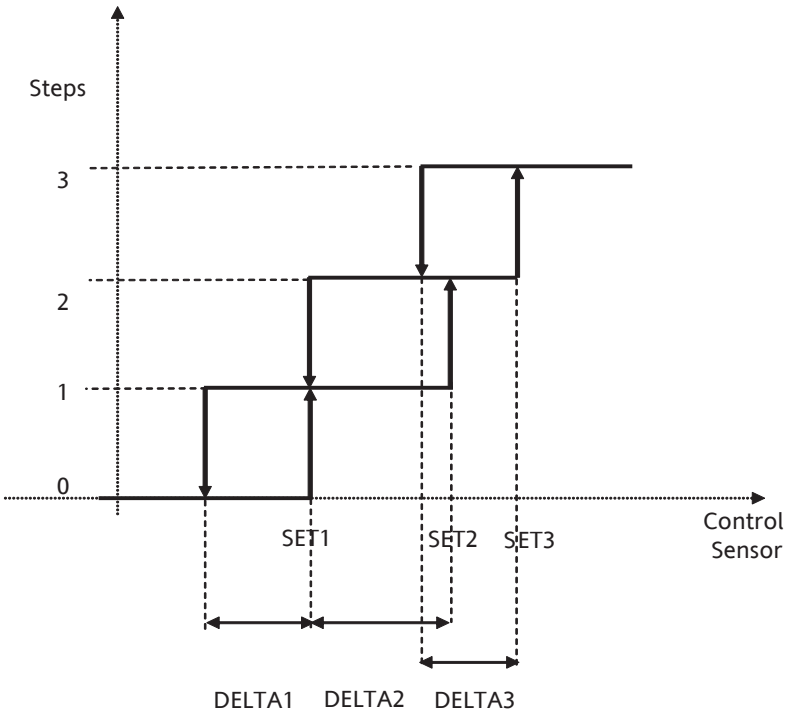
3.7.1 Fan control by steps

The *fan control by steps* is used when there is more than one fan for each condenser and the parameter *FANS_CONTROL*_FUNCTION=DIGITAL
The number of steps for each fan battery is determined by the *parameters FANS*_NO_1, *FANS*_NO_2 (each step corresponds to one fan). *FANS*_NO_i i=ith fan battery is taken into account only if the battery concerned exists (see CIR_*FANS*_j, j=jth *circuit*).

The length of time in which the fan battery is forced at maximum power when the first fan of the battery starts can be fixed using the parameter *FANS*_CH_INIT_MAX_POWER_TIME.

Cooling Mode

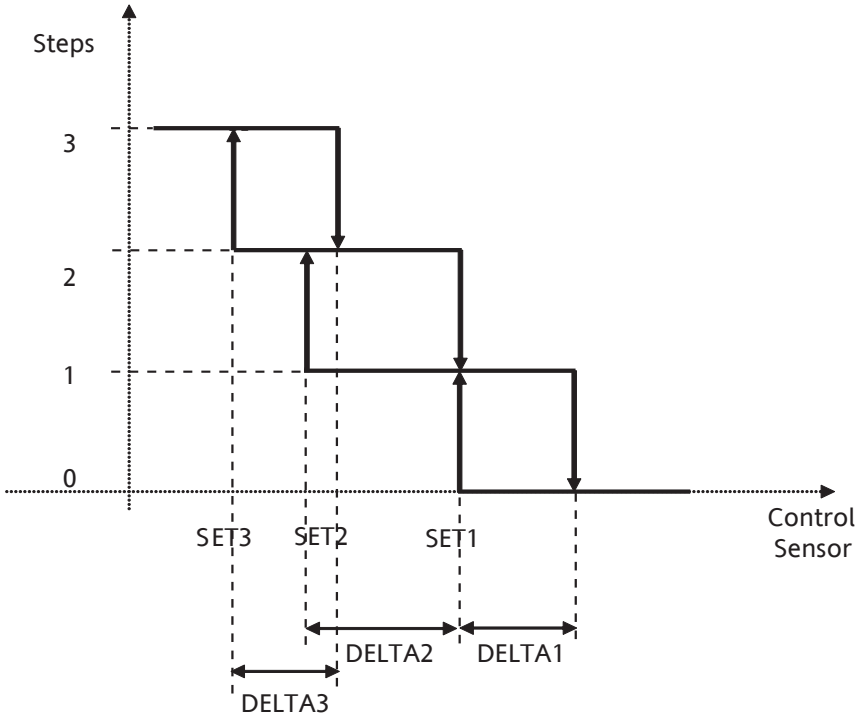
The nth step is activated when the *control* sensor reaches the setpoint set with the parameter SETn. The nth step is deactivated when the *control* sensor reaches the value given by SETn – DELTAn.



Control sensor	If *FANS_CONTROL*_INPUT_SOURCE = pressure → MAX(CIR_PRES_MAX_SENS_i_PHY), i = ith *circuit* of the fan battery If *FANS_CONTROL*_INPUT_SOURCE = temperature → MAX(CIR_TEMP_COND_SENS_i_PHY), i = ith *circuit* of the fan battery (the sensors with errors are not taken into account for the maximum)
SETn	*FANS*_CSTART_SETn_PRES/ *FANS*_CSTART_SETn_TEMP
DELTAn	*FANS*_CSTOP_DELTAn_PRES/ *FANS*_CSTOP_DELTAn_TEMP
Steps	*FANS*_ACCj_DO_i_PHY, j=jth fan of the ith battery

Heating Mode

The nth step is activated when the *control* sensor is less than or equal to setpoint set with the parameter SETn.
The nth step is deactivated when the *control* sensor reaches the value given by SETn + DELTAn.



Control sensor	If *FANS_CONTROL*_INPUT_SOURCE = pressure → MIN(CIR_PRES_MAX_SENS_i_PHY), i = ith *circuit* of the fan battery If *FANS_CONTROL*_INPUT_SOURCE = temperature → MIN(CIR_TEMP_COND_SENS_i_PHY), i = ith *circuit* of the fan battery (the sensors with errors are not taken into account for the minimum)
SETn	*FANS*_HSTART_SETn_PRES/ *FANS*_HSTART_SETn_TEMP
DELTAn	*FANS*_HSTOP_DELTAn_PRES/ *FANS*_HSTOP_DELTAn_TEMP
Steps	*FANS*_ACCj_DO_i_PHY, j=jth fan of the ith fan battery.

Note: If there is an error in all the maximum pressure sensors (*FANS_CONTROL*_INPUT_SOURCE =pressure) or all the temperature sensors on the condenser (*FANS_CONTROL*_INPUT_SOURCE=temperature) of the fan battery circuits, all the *fans* of the battery concerned are switched *off*.

3.7.1.1 Fans with same/different power

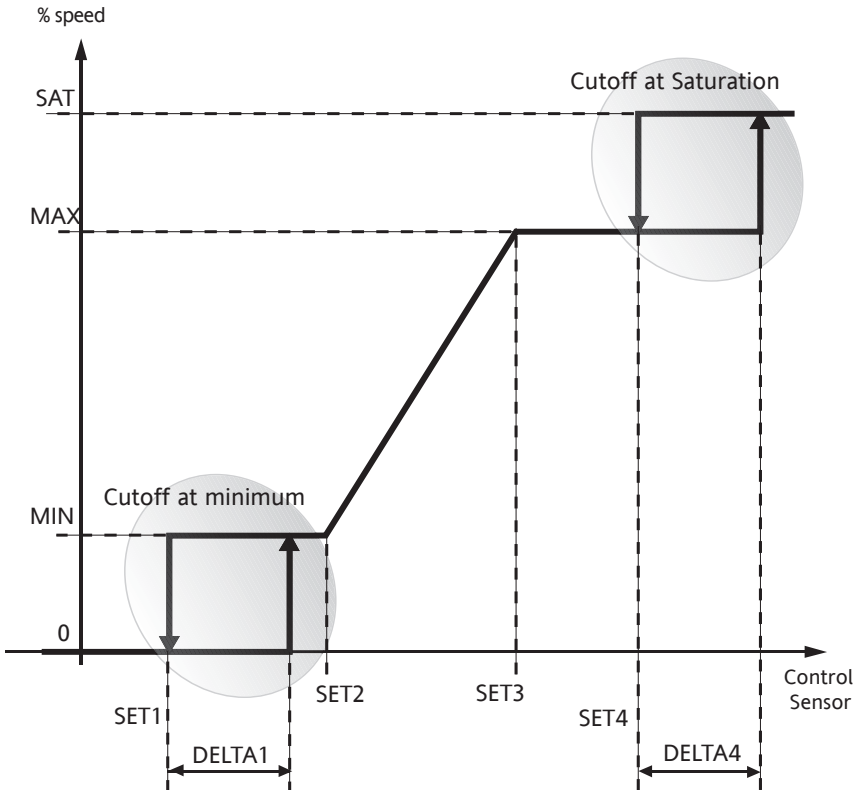
If the *fans* belonging to the same condenser are all the same, activation is of the continuous type (if 3 steps are requested, 3 *fans* are active).
If the *fans* have different powers (this option is settable with parameter *FANS*_ASYMMETRICAL_FLAG), the *fans* are activated alternately (on activating fan 3, fan 2 is deactivated).

3.7.2 Fan control in continuous mode

Continuous fan *control* is used when there is a fan that can be controlled in continuous mode for each condenser, and parameter *FANS_CONTROL*_FUNCTION = CONT. The *parameters FANS*_NO_i ; i=ith fan battery, are not taken into account since each fan battery is automatically assigned its own single analogue output.

Cooling Mode

The following shows ventilation behaviour in *Chiller* mode when the pick-up time and Cutoff bypass time are zero and parameter CUTOFF_CH_ENABLED_FLAG is equal to YES. Also see the section on VENTILATION MINIMUM START TIME.



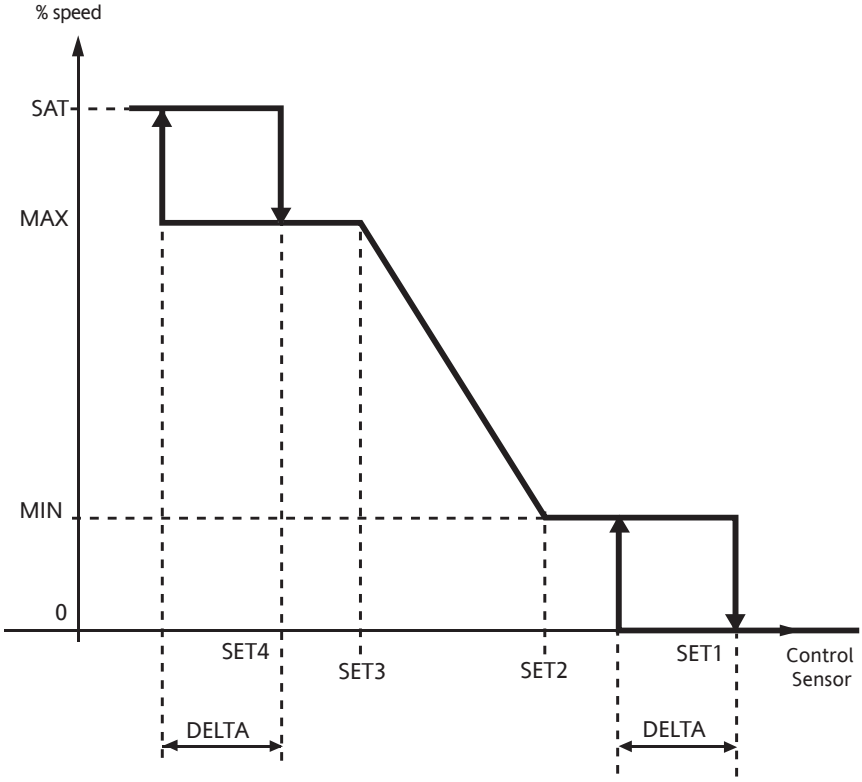
Control sensor	If *FANS_CONTROL*_INPUT_SOURCE = pressure → MAX(CIR_PRES_MAX_SENS_i_PHY), i = ith *circuit* of the fan battery If *FANS_CONTROL*_INPUT_SOURCE = temperature → MAX(CIR_TEMP_COND_SENS_i_PHY), i = ith *circuit* of the fan battery (the sensors with errors are not taken into account for the maximum)
SET1	CUTOFF_CH_SETPOINT1_PRES/ CUTOFF_CH_SETPOINT1_TEMP
DELTA1	CUTOFF_CH_DELTA1_PRES/ CUTOFF_CH_DELTA1_TEMP
SET2	*FANS*_CH_START_PRES/ *FANS*_CH_START_TEMP
SET3	*FANS*_CH_SATURATION_PRES/ *FANS*_CH_SATURATION_TEMP
SET4	CUTOFF_CH_SETPOINT2_PRES/ CUTOFF_CH_SETPOINT2_TEMP
DELTA4	CUTOFF_CH_DELTA2_PRES/ CUTOFF_CH_DELTA2_TEMP
SAT	*FANS*_CH_SAT_SPEED
MAX	*FANS*_CH_MAX_SPEED
MIN	*FANS*_CH_MIN_SPEED
Speed	*FANS*_CTRL_AO_j_PHY, % speed of jth fan battery

If the parameter CUTOFF_CH_ENABLED_FLAG = NO the chart changes, and there is no Cutoff hysteresis *:*

- Cutoff at minimum: the fan speed goes from 0 to MIN when the *control* Sensor reaches SET2 “from below". If the *control* Sensor reaches SET2 “from above” MIN speed goes to 0.
- saturation cutoff: when the *control* Sensor reaches SET3 “from below”, fan speed is at MAX. If the *control* Sensor reaches SET3 “from above” there is continuous *control* between MAX and MIN.

Heating Mode

Shown below is the behaviour of ventilation in Heat *pump* mode when the pick-up time and Cutoff bypass time are zero and parameter CUTOFF_CH_ENABLED_FLAG is equal to YES. Also see the section on **VENTILATION MINIMUM START TIME**.



Control sensor	If *FANS_CONTROL*_INPUT_SOURCE = pressure → MIN(CIR_PRES_MAX_SENS_i_PHY), i = ith *circuit* of the fan battery If *FANS_CONTROL*_INPUT_SOURCE = temperature → MIN(CIR_TEMP_COND_SENS_i_PHY), i = ith *circuit* of the fan battery (the sensors with errors are not taken into account for the minimum)
SET1	CUTOFF_HP_SETPOINT1_PRES/ CUTOFF_HP_SETPOINT1_TEMP
DELTA	CUTOFF_HP_DELTA1_PRES/ CUTOFF_HP_DELTA1_TEMP
SET2	*FANS*_HP_START_PRES/ *FANS*_HP_START_TEMP
SET3	*FANS*_HP_SATURATION_PRES/ *FANS*_HP_SATURATION_TEMP
SET4	CUTOFF_HP_SETPOINT2_PRES/ CUTOFF_HP_SETPOINT2_TEMP
DELTA4	CUTOFF_HP_DELTA2_PRES/ CUTOFF_HP_DELTA2_TEMP
SAT	*FANS*_HP_SAT_SPEED
MAX	*FANS*_HP_MAX_SPEED
MIN	*FANS*_HP_MIN_SPEED
Speed *:*	*FANS*_CTRL_AO_j_PHY, % speed of jth fan battery

If the parameter CUTOFF_CH_ENABLED_FLAG = NO, the chart changes and there is no Cutoff hysteresis *:*

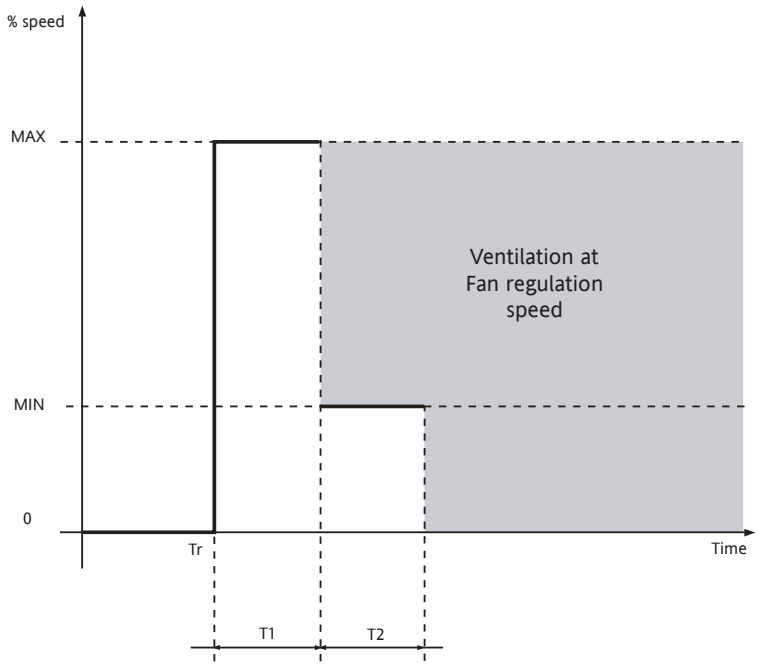
- Cutoff at minimum: the fan speed goes from 0 to MIN when the *control* Sensor reaches SET2 “from above. If the *control* Sensor reaches SET2 “from below" the speed goes from MIN to 0.
- saturation cutoff: when the *control* Sensor reaches SET3 “from below”, fan speed is MAX. If the *control* Sensor reaches SET3 “from above” there is continuous *control* between MAX and MIN.

Note that if the time during which *fans* are forced at full power (*FANS*_CH_INIT_MAX_POWER_TIME/ *FANS*_HP_INIT_MAX_POWER_TIME) the *fans* are controlled
at SAT power if Cutoff is enabled, and at MAX power if Cutoff is not enabled.

Note: If there is an error in all the maximum pressure sensors (*FANS_CONTROL*_INPUT_SOURCE =pressure) or all the temperature sensors on the condenser (*FANS_CONTROL*_INPUT_SOURCE=temperature) of the fan batttery circuits, all the *fans* of the battery concerned are switched *off*.

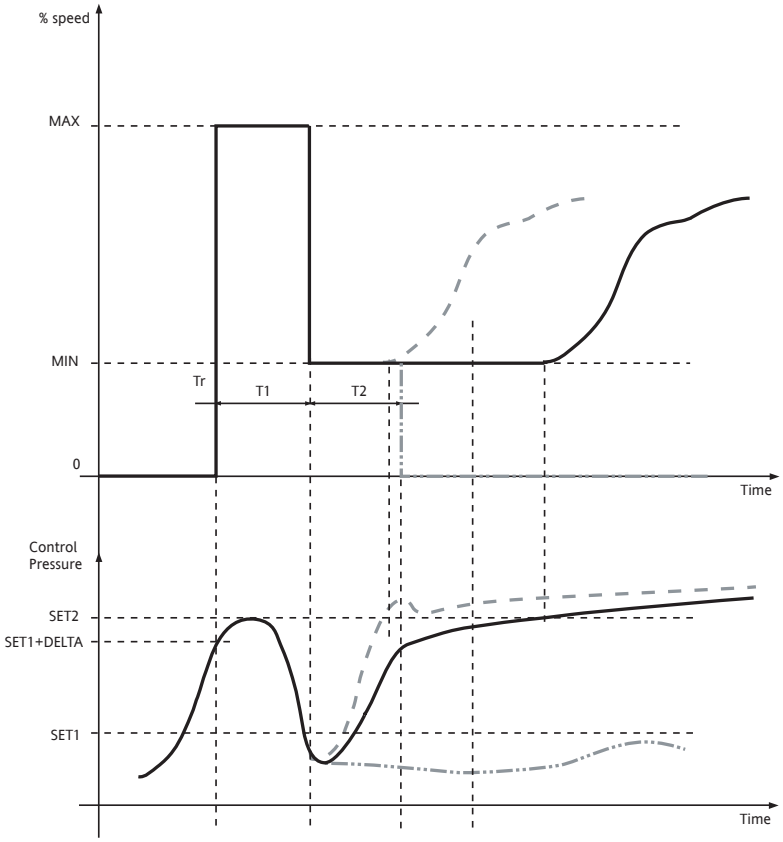
3.7.2.2 Ventilation minimum On time

After pick-up, for the time settable by parameter (*FANS*_CH_MIN_ON_TIME/*FANS*_HP_MIN_ON_TIME) the *fans* operate at least at minimum speed; after this time, the *fans* can be stopped by a request from the fan controller. The *fans* are also stopped if there is a fan blocking alarm.
The following chart illustrates the above



Tr	Moment when ventilation is requested
T1	*FANS*_CH_INIT_MAX_POWER_TIME/ *FANS*_HP_INIT_MAX_POWER_TIME
T2	CUTOFF_CH_BYPASS_TIME/ CUTOFF_HP_BYPASS_TIME
MAX	*FANS*_CH_MAX_SPEED/ *FANS*_HP_MAX_SPEED or *FANS*_CH_SAT_SPEED /*FANS*_HP_SAT_SPEED
MIN	*FANS*_CH_MIN_SPEED /*FANS*_HP_MIN_SPEED

The following chart shows the effect of pick-up and minimum On time on fan speed following a ventilation activation request. For the sake of simplicity, the example refers to *Chiller* mode only:



Tr	Moment when ventilation is requested
T1	*FANS*_CH_INIT_MAX_POWER_TIME
T2	CUTOFF_CH_BYPASS_TIME
MAX	*FANS*_CH_MAX_SPEED or *FANS*_CH_SAT_SPEED
MIN	*FANS*_CH_MIN_SPEED
SET1	CUTOFF_CH_SETPOINT_PRES/ CUTOFF_CH_SETPOINT_TEMP
DELTA	CUTOFF_CH_DELTA_PRES/ CUTOFF_CH_DELTA_TEMP
SET2	*FANS*_CH_START_PRES/ *FANS*_CH_START_TEMP

Note that if Cutoff is enabled, MAX is represented by the *parameters FANS*_CH_SAT_SPEED/*FANS*_HP_SAT_SPEED. If Cutoff is not enabled, MAX is represented by the *parameters FANS*_CH_MAX_SPEED/*FANS*_HP_MAX_SPEED

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
208	CIR_*FANS*_1	Association of *circuit* 1 with the fan group indicated	1...2	1	0	C	V		num
209	CIR_*FANS*_2	Association of *circuit* 2 with the fan group indicated	0...2	1	0	C	V		num
20A	CIR_*FANS*_3	Association of *circuit* 3 with the fan group indicated	0...2	2	0	C	V		num
20B	CIR_*FANS*_4	Association of *circuit* 4 with the fan group indicated	0...2	2	0	C	V		num
20C	CIR_*FANS*_5	Association of *circuit* 5 with the fan group indicated	0...2	0	0	C	V		num
20D	CIR_*FANS*_6	Association of *circuit* 6 with the fan group indicated	0...2	0	0	C	V		num
20E	CIR_*FANS*_7	Association of *circuit* 7 with the fan group indicated	0...2	0	0	C	V		num
20F	CIR_*FANS*_8	Association of *circuit* 8 with the fan group indicated	0...2	0	0	C	V		num
219	*FANS*_ASYMMETRICAL_FLAG	*Fans* all the same (NO) or with increasing power (YES). Intervenes on the fan relay activation/deactivation sequence	0...1	0	6	C	V	0=NO, 1=YES	flag
21A	*FANS*_NO_1	Number of *fans* in battery 1	1...4	3	0	C	V		num
21B	*FANS*_NO_2	Number of *fans* in battery 2	1...4	3	0	C	V		num
21C	*FANS*_NO_3	Number of *fans* in battery 3	1...4	1	0	C	N		num
21D	*FANS*_NO_4	Number of *fans* in battery 4	1...4	1	0	C	N		num
21E	*FANS*_NO_5	Number of *fans* in battery 5	1...4	1	0	C	N		num
21F	*FANS*_NO_6	Number of *fans* in battery 6	1...4	1	0	C	N		num
220	*FANS*_NO_7	Number of *fans* in battery 7	1...4	1	0	C	N		num
221	*FANS*_NO_8	Number of *fans* in battery 8	1...4	1	0	C	N		num
340	*FANS*_KOMP_DEPENDENCY_FLAG	If NO, the *fans* of the batteries operate independently of the status of the compressors belonging to the circuits in which the batteries *control* the condensation, otherwise at least one of the compressors must be on so that battery fan *control* can be effected.	0...1	1	6	C	V	0=NO, 1=YES	flag
341	*FANS*_CH_INIT_MAX_POWER_TIME	The time the fan battery *fans* are operating at full power whenever the battery is started	0...120	60	0	C	V		sec
342	*FANS*_HP_INIT_MAX_POWER_TIME	The time the *fans* in the fan batteries are operating at full power whenever the battery is started in *heating mode*	0...120	60	0	C	V		sec
343	*FANS_CONTROL*_FUNCTION	Selection of type of fan *control* and actuation	0...1	0	31	C	V	0=CONT, 1=DIGITAL	flag
344	CUTOFF_CH_ENABLED_FLAG	Enable CUTOFF in *chiller* mode	0...1	1	6	C	V	0=NO, 1=YES	flag
345	CUTOFF_HP_ENABLED_FLAG	Enable CUTOFF in heat *pump* mode	0...1	1	6	C	V	0=NO, 1=YES	flag
346	*FANS_CONTROL*_INPUT_SOURCE	Sensor for *condensation control*	0..1	1	24	C	V	0=temperature 1=pressure	flag
360	*FANS*_CSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in *cooling mode*	0.0...50.0	13.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
361	*FANS*_CSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in *cooling mode*	0.0...50.0	15.0	0	C	V		Bar
362	*FANS*_CSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in *cooling mode*	0.0...50.0	17.0	0	C	V		Bar
363	*FANS*_CSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in *cooling mode*	0.0...50.0	19.0	0	C	V		Bar
364	*FANS*_CSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
365	*FANS*_CSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
366	*FANS*_CSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
367	*FANS*_CSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
368	*FANS*_CSTOP_DELTA1_PRES	Pressure Delta for deactivating ventilation step 1 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
369	*FANS*_CSTOP_DELTA2_PRES	Pressure Delta for deactivating ventilation step 2 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36A	*FANS*_CSTOP_DELTA3_PRES	Pressure Delta for deactivating ventilation step 3 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36B	*FANS*_CSTOP_DELTA4_PRES	Pressure Delta for deactivating ventilation step 4 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36C	*FANS*_CSTOP_DELTA5_PRES	Pressure Delta for deactivating ventilation step 5 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36D	*FANS*_CSTOP_DELTA6_PRES	Pressure Delta for deactivating ventilation step 6 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36E	*FANS*_CSTOP_DELTA7_PRES	Pressure Delta for deactivating ventilation step 7 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36F	*FANS*_CSTOP_DELTA8_PRES	Pressure Delta for deactivating ventilation step 8 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
370	*FANS*_CSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in *cooling mode*	-50.0....150.0	18.0	0	C	V		°C
371	*FANS*_CSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in *cooling mode*	-50.0....150.0	25.0	0	C	V		°C
372	*FANS*_CSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in *cooling mode*	-50.0...150.0	35.0	0	C	V		°C
373	*FANS*_CSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in *cooling mode*	-50.0....150.0	40.0	0	C	V		°C
374	*FANS*_CSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in *cooling mode*	-50.0...150.0	0.0	0	C	V		°C
375	*FANS*_CSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in *cooling mode*	-50.0....150.0	0.0	0	C	V		°C
376	*FANS*_CSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in *cooling mode*	-50.0....150.0	0.0	0	C	V		°C
377	*FANS*_CSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in *cooling mode*	-50.0...150.0	0.0	0	C	V		°C
378	*FANS*_CSTOP_DELTA1_TEMP	Temperature Delta for deactivating ventilation step 1 in *cooling mode*	0.0....25.5	2.0	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
379	*FANS*_CSTOP_DELTA2_TEMP	Temperature Delta for deactivating ventilation step 2 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C
37A	*FANS*_CSTOP_DELTA3_TEMP	Temperature Delta for deactivating ventilation step 3 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C
37B	*FANS*_CSTOP_DELTA4_TEMP	Temperature Delta for deactivating ventilation step 4 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C
37C	*FANS*_CSTOP_DELTA5_TEMP	Temperature Delta for deactivating ventilation step 5 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37D	*FANS*_CSTOP_DELTA6_TEMP	Temperature Delta for deactivating ventilation step 6 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37E	*FANS*_CSTOP_DELTA7_TEMP	Temperature Delta for deactivating ventilation step 7 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37F	*FANS*_CSTOP_DELTA8_TEMP	Temperature Delta for deactivating ventilation step 8 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
3A0	*FANS*_CH_MIN_ON_TIME	Minimum ventilation on time in *chiller* mode at least at minimum speed	0...120	30	0	C	V		sec
3A1	CUTOFF_CH_SETPOINT1_PRES	Pressure value below which CUTOFF at minimum switches *off* ventilation in *Chiller* mode	0.0...60.0	8.0	0	C	V		Bar
3A2	CUTOFF_CH_DELTA1_PRES	Pressure value to be added to CUTOFF_CH_SETPOINT1_PRES. If the ventilation *control* pressure exceeds this total, the *control* changes from ON/*OFF* (due to CUTOFF at minimum) to continuous in *Chiller* mode	0.0...10.0	1.0	0	C	V		Bar
3A3	*FANS*_CH_START_PRES	Pressure value at which modulated ventilation *control* begins in *Chiller* mode. The fan speed, expressed as a percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	0.0...60.0	10.0	0	C	V		Bar
3A4	*FANS*_CH_SATURATION_PRES	Pressure value at which fan speed goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Chiller* mode	0.0...60.0	20.0	0	C	V		Bar
3A5	*FANS*_CH_MIN_SPEED	Percentage value of minimum ventilation speed in *Chiller* mode	0...100	20	0	C	V		%
3A6	*FANS*_CH_MAX_SPEED	Percentage value of maximum ventilation speed in *Chiller* mode at end of gradient.	0...100	80	0	C	V		%
3A7	CUTOFF_CH_SETPOINT2_PRES	Pressure value below which saturation CUTOFF changes the *control* from ON/*OFF* (due to saturation CUTOFF) to continuous in *Chiller* mode	0.0...60.0	21.0	0	C	V		Bar
3A8	CUTOFF_CH_DELTA2_PRES	Pressure value to be added to CUTOFF_CH_SETPOINT2_PRES. If the ventilation *control* pressure exceeds this total, the fan speed will be equal to the value of parameter *FANS*_CH_SAT_SPEED.	0.0...10.0	1.0	0	C	V		Bar
3A9	*FANS*_CH_SAT_SPEED	Percentage value of maximum ventilation speed in *Chiller* mode	0...100	90	0	C	V		%
3AA	CUTOFF_CH_SETPOINT1_TEMP	Temperature value below which the CUTOFF at minimum switches *off* ventilation in *Chiller* mode	-50.0...150.0	16.0	0	C	V		°C
3AB	CUTOFF_CH_DELTA1_TEMP	Temperature value to be added to CUTOFF_CH_SETPOINT1_TEMP. If the ventilation *control* temperature exceeds this total, the *control* changes from ON/*OFF* (due to CUTOFF at minimum) to continuous in *Chiller* mode	0.0...25.5	1.0	0	C	V		°C
3AC	*FANS*_CH_START_TEMP	Temperature value at which modulated ventilation *control* starts in *Chiller* mode. The fan speed, expressed as a percentage, is equal to the value of parameter	-50.0...150.0	18.0	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
		*FANS*_CH_MIN_SPEED							
3AD	*FANS*_CH_SATURATION_TEMP	Temperature value at which ventilation goes to the maximum speed defined by parameter *FANS*_CH_MAX_SPEED in *Chiller* mode	-50.0...150.0	50.0	0	C	V		°C
3AE	CUTOFF_CH_SETPOINT2_TEMP	Temperature value below which saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Chiller* mode	-50.0...150.0	51.0	0	C	V		°C
3AF	CUTOFF_CH_DELTA2_TEMP	Temperature value to be added to CUTOFF_CH_SETPOINT2_TEMP. If the ventilation *control* temperature exceeds this total, fan speed will be equal to the value of parameter *FANS*_CH_SAT_SPEED.	0.0...25.5	1.0	0	C	V		°C
3C0	*FANS*_HSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in *heating mode*	0.0...50.0	12.0	0	C	V		Bar
3C1	*FANS*_HSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in *heating mode*	0.0...50.0	10.0	0	C	V		Bar
3C2	*FANS*_HSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in *heating mode*	0.0...50.0	8.0	0	C	V		Bar
3C3	*FANS*_HSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in *heating mode*	0.0...50.0	6.0	0	C	V		Bar
3C4	*FANS*_HSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C5	*FANS*_HSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C6	*FANS*_HSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C7	*FANS*_HSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C8	*FANS*_HSTOP_DELTA1_PRES	Pressure Delta for deactivating ventilation step 1 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3C9	*FANS*_HSTOP_DELTA2_PRES	Pressure Delta for deactivating ventilation step 2 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CA	*FANS*_HSTOP_DELTA3_PRES	Pressure Delta for deactivating ventilation step 3 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CB	*FANS*_HSTOP_DELTA4_PRES	Pressure Delta for deactivating ventilation step 4 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CC	*FANS*_HSTOP_DELTA5_PRES	Pressure Delta for deactivating ventilation step 5 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CD	*FANS*_HSTOP_DELTA6_PRES	Pressure Delta for deactivating ventilation step 6 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CE	*FANS*_HSTOP_DELTA7_PRES	Pressure Delta for deactivating ventilation step 7 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CF	*FANS*_HSTOP_DELTA8_PRES	Pressure Delta for deactivating ventilation step 8 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3D0	*FANS*_HSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in *heating mode*	-50.0...150.0	40.0	0	C	V		°C
3D1	*FANS*_HSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in *heating mode*	-50.0...150.0	35.0	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
3D2	*FANS*_HSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in *heating mode*	-50.0...150.0	25.0	0	C	V		°C
3D3	*FANS*_HSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in *heating mode*	-50.0...150.0	18.0	0	C	V		°C
3D4	*FANS*_HSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D5	*FANS*_HSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D6	*FANS*_HSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D7	*FANS*_HSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D8	*FANS*_HSTOP_DELTA1_TEMP	Temperature Delta for deactivating ventilation step 1 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3D9	*FANS*_HSTOP_DELTA2_TEMP	Temperature Delta for deactivating ventilation step 2 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DA	*FANS*_HSTOP_DELTA3_TEMP	Temperature Delta for deactivating ventilation step 3 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DB	*FANS*_HSTOP_DELTA4_TEMP	Temperature Delta for deactivating ventilation step 4 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DC	*FANS*_HSTOP_DELTA5_TEMP	Temperature Delta for deactivating ventilation step 5 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DD	*FANS*_HSTOP_DELTA6_TEMP	Temperature Delta for deactivating ventilation step 6 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DE	*FANS*_HSTOP_DELTA7_TEMP	Temperature Delta for deactivating ventilation step 7 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DF	*FANS*_HSTOP_DELTA8_TEMP	Temperature Delta for deactivating ventilation step 8 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
400	*FANS*_HP_MIN_ON_TIME	Minimum On time for ventilation in Heat *pump* mode at least at minimum speed	0...120	30	0	C	V		sec
401	CUTOFF_HP_SETPOINT1_PRES	Pressure value above which the CUTOFF switches *off* ventilation in *Pump* mode	0.0...60.0	22.0	0	C	V		Bar
402	CUTOFF_HP_DELTA1_PRES	Pressure value to be subtracted from CUTOFF_CH_SETPOINT1_PRES. If the ventilation *control* pressure goes below this difference, the *control* changes from ON/*OFF* (due to CUTOFF) to continuous in *Pump* mode	0.0...10.0	1.0	0	C	V		Bar
403	*FANS*_HP_START_PRES	Pressure value at which modulated ventilation *control* is started in *Pump* mode. The fan speed, as a percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	0.0...60.0	20.0	0	C	V		Bar
404	*FANS*_HP_SATURATION_PRES	Pressure value at which ventilation goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Pump* mode	0.0...60.0	10.0	0	C	V		Bar
405	*FANS*_HP_MIN_SPEED	Percentage value of minimum ventilation speed in *Pump* mode	0...100	40	0	C	V		%
406	*FANS*_HP_MAX_SPEED	Percentage value of maximum ventilation speed in *Pump* mode	0...100	80	0	C	V		%
407	CUTOFF_HP_SETPOINT2_PRES	Pressure value above which the saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Pump* mode.	0.0...60.0	9.0	0	C	V		Bar
408	CUTOFF_HP_DELTA2_PRES	Pressure value to be subtracted from	0.0...10.0	1.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
		CUTOFF_HP_SETPOINT2_PRES. If the ventilation *control* pressure is below this value, the fan speed will be equal to parameter *FANS*_HP_SAT_SPEED.							
409	*FANS*_HP_SAT_SPEED	Percentage value of maximum ventilation speed in *Pump* mode.	0...100	90	0	C	V		%
40A	CUTOFF_HP_SETPOINT1_TEMP	Temperature value below which the CUTOFF switches *off* ventilation in *Pump* mode	-50.0...150.0	52.0	0	C	V		°C
40B	CUTOFF_HP_DELTA1_TEMP	Temperature value in *heating mode* to be subtracted from CUTOFF_HP_SETPOINT1_TEMP. If the ventilation *control* temperature goes below this difference, the *control* changes from ON/*OFF* (due to CUTOFF) to continuous in *Pump* mode	0.0...25.5	1.0	0	C	V		°C
40C	*FANS*_HP_START_TEMP	Temperature value at which modulated ventilation *control* is started in *Pump* mode. The fan speed, as a percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	-50.0...150.0	50.0	0	C	V		°C
40D	*FANS*_HP_SATURATION_TEMP	Temperature value at which ventilation goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Pump* mode	-50.0...150.0	18.0	0	C	V		°C
40E	CUTOFF_HP_SETPOINT2_TEMP	Temperature value above which saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Pump* mode.	-50.0...150.0	17.0	0	C	V		°C
40F	CUTOFF_HP_DELTA2_TEMP	Temperature value in *Pump* mode to be subtracted from CUTOFF_HP_SETPOINT2_TEMP. If the ventilation *control* temperature is below this value, the fan speed will be equal to parameter *FANS*_HP_SAT_SPEED.	0.0...25.5	1.0	0	C	V		°C

3.8 Hydraulic pump control

The system provides for individual *control* of the pumps in the *pump* group to enable circulation of the intermediate fluid (the controller starts/stops the individual pumps).
The number of pumps managed is equal to the parameter PUMPS_NO, in this case set to 2.

3.8.1 Hours of pump use

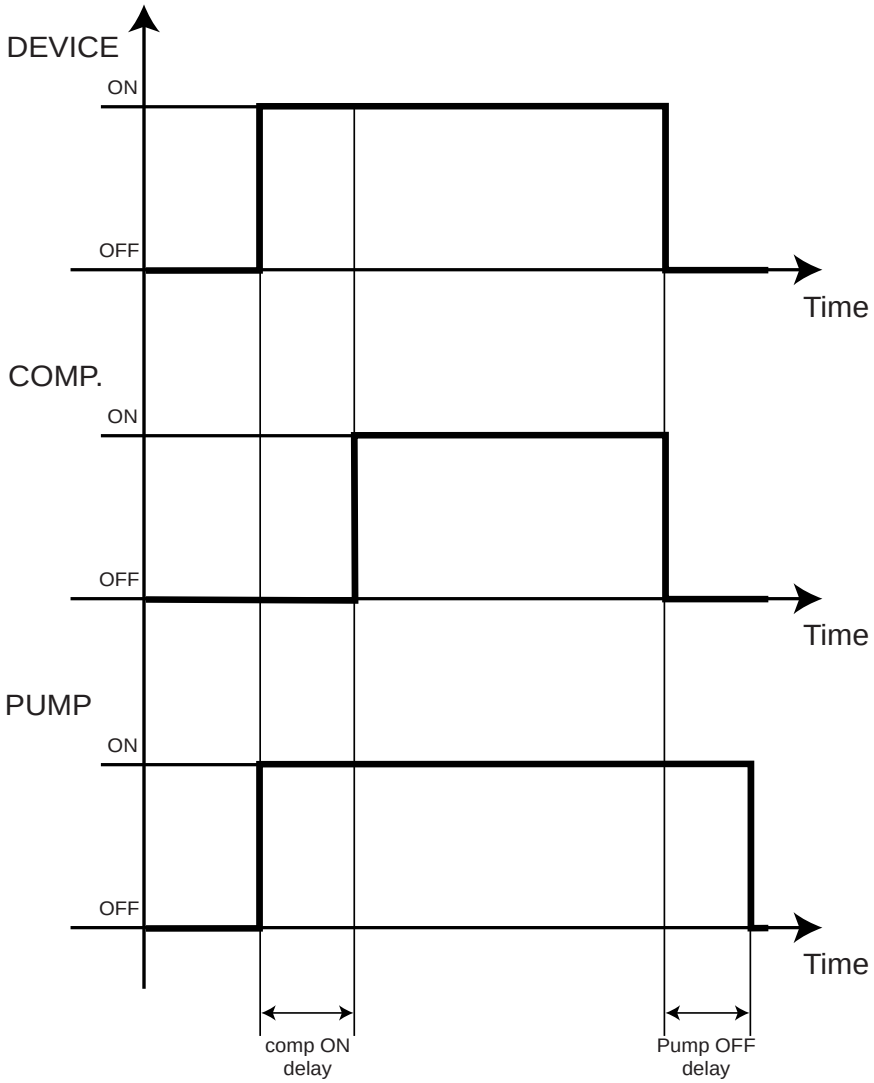
The operating time of the pumps is stored every hour in EEPROM, in the following two *parameters :*

- *PUMP*_USAGE_DAYS_i, : days of use of ith *pump*
- *PUMP*_USAGE_HOUR_i, : hours of use of ith *pump*

3.8.2 Continuous operation

With *continuous operation*, the *pump* group is always active.

- The *pump* is started when the device is switched on
- The *compressor* is activated with a delay (PUMPGROUP_STARTUP_DELAY_TIME) after the *pump* is started
- The *pump* is stopped with a delay (PUMPGROUP_STOP_DELAY_YIME) after the last *compressor* is switched *off*.



STRUM.	Device status
COMPR.	*Compressor* status
PUMP	*Pump* status
Comp ON delay	PUMPGROUP_STARTUP_DELAY_TIME
Pump OFF delay	PUMPGROUP_STOP_DELAY_TIME

⚠

NOTE: The *pump* group can be activated even with the device *Off*, whenever activation of the *antifreeze* heaters is requested. (See par. *Antifreeze*)

3.8.2.1 Timed Swap

While a *pump* is operating, a counter counts the rotation time (set by parameter PUMPS_ALTERNATION_TIME) at the end of which the active *pump* is switched *off* and the second *pump* in the *circuit* is activated.
If the second *pump* is not available at the end of the rotation time, the *pump* currently selected remains active until the second one becomes available.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
222	PUMPS_NO	Number of system pumps	1...2	2	0	C	V		num
463	PUMPS_ALTERNATION_TIME	Association of *circuit* 2 with the fan group indicated	1...1000	72	0	C	V		hours
464	PUMPGROUP_STARTUP_DELAY_TIME	Time delay between system ON (which consequently causes activation of the selected *pump*) and start of temperature *control*	0...2000	60	0	C	V		sec
465	PUMPGROUP_STOP_DELAY_TIME	Time the active *pump* must remain on after a system *Off* request and the last *compressor* is switched *off*	0...2000	60	0	C	V		sec
480	*PUMP*_USAGE_DAYS_1	Days of use of *pump* 1	0...32000	0	0	C	V		num
481	*PUMP*_USAGE_DAYS_2	Days of use of *pump* 2	0...32000	0	0	C	V		num
482	*PUMP*_USAGE_HOUR_1	Hours of use of *pump* 1	0...24	0	0	C	V		hours
483	*PUMP*_USAGE_HOUR_2	Hours of use of *pump* 2	0...24	0	0	C	V		hours

3.9 Refrigeration resources selection

3.9.1 Availability

For each level of components in the system (*EVAPORATOR*, *CIRCUIT*, *COMPRESSOR*) the minimum *availability* (taken as the sum of minimum availabilities) and maximum *availability* (taken as the sum of maximum availabilities) of the subsystems is calculated in cascade from the compressors to the evaporators.
If there is an alarm in a subsystem, the minimum and maximum availabilities are always reset.
If a subsystem is counting safety times, its maximum and minimum availabilities are blocked and assume the same value equal to the power delivered at that moment.

Example
In a *circuit* having 2 compressors with 3 *capacity steps* (i.e. levels 0,1,2,3,4), with the minimum and maximum *availability* and accessibility of a component given in squares brackets,:

- the *circuit* in alarm status has *availability* [0.0] and accessibility time [0.0].
- the switched *off circuit* with compressors that cannot be started due to protection times has *availability* [0.0] and accessibility [0.8]
- the *circuit* in which one *compressor* is on and blocked at level 2 and the other is disabled, has *availability* [2.2] and accessibility is [0.4].

3.9.2 Control

For each level of system components (*EVAPORATOR*, *CIRCUIT*, *COMPRESSOR*) a parameter (EV_SELECTION_FUNCTION, CIR_SELECTION_FUNCTION, KOMP_SELECTION_FUNCTION) can be used to set the selection policy applied by the temperature controller for distributing refrigeration resources: the policies available are Saturation and Balancing.

The selection policies are mainly based on the hours of *compressor* operation.
For elements at higher hierarchical levels than the *compressor* (*circuit*, *evaporator*), the hours of use are taken as the sum of hours of use of the compressors contained in the component.

With the use of hermetic and semihermetic compressors, the minimum unit of refrigerating capacity now managed by temperature controller, commonly called a “step”, corresponds to one *compressor* capacity step in the case of part loading *compressor*, or to the *compressor* itself if not part loading.

The selection policies are applied in cascade with respect to the system components. When there is a request from the temperature controller to activate/deactivate a step, the request is assigned to the best *EVAPORATOR* (according to the *evaporator* selection policy selected with the EV_SELECTION_FUNCTION parameter), and then to the best *EVAPORATOR CIRCUIT* (according to the selection policy selected with the CIR_SELECTION_FUNCTION parameter), and lastly to the best *COMPRESSOR* IN THE *CIRCUIT* (according to the *compressor selection* policy selected with the KOMP_SELECTION_FUNCTION parameter).

3.9.3 Balancing characteristics

Balancing (irrespective of the component to which it is applied) obeys the following rules:

1. static nature: if the current assignments of refrigeration resources meet the current demand, they are not changed;

2. within the same *control* cycle, requests to increment/decrement by more than one step are managed as sequences of increments/decrements of one step, as described in points 3) and 4);

3. with a one step increment request, the components that can be incremented are taken into consideration, and the one at minimum distance from its minimum *availability* value is selected. At equal distance, the one with least hours of use is selected;

4. with a one step decrement request, the components that can be decreased are taken into consideration, and the one at maximum distance from its minimum *availability* value is selected. At equal distance, the component with the highest hours of use is selected;

5. resources are allocated taking account of the levels of *availability* of the components controlled.

3.9.4 Compressor

A *compressor* is defined as *saturated* when it is at its maximum output (maximum number of power steps deliverable). For a *compressor* with *capacity steps*, the *compressor* activation level is understood as the number of steps it is supplying at that moment (e.g. a *compressor* with 3 *capacity steps* will have a maximum of 4 activation levels/steps).
The activation requirements (increments/decrements) of level steps for compressors inside the same *circuit* are as follows.

3.9.4.1 Compressor saturation

The saturation policy seeks to distribute resources to the smallest possible number of compressors, compatibly with the constraints imposed by other requirements, such as: safety times for compressors, maximum number of starts in one hour. The resulting allocation is such as to have the largest possible number of compressors switched *off* at any one time.

3.9.4.2 Compressor balancing

The balancing policy seeks to distribute resources equally to the largest possible number of compressors, compatibly with the constraints imposed by other requirements, such as: safety times, maximum number of starts in one hour. The resulting allocation is such as to have the greatest possible equalisation of delivery levels in the compressors at any one time.

3.9.5 Circuit

A *circuit* is defined as *saturated* when it is at its maximum output (sum of the maximum number of power steps deliverable by the compressors belonging to the *circuit*). A *circuit* is said to be active or on if has at least one *compressor* with a step activated, and *off* if none of the compressors are on. The current activation level of a particular *circuit* is defined as the total number of steps that the compressors are supplying at the time (e.g. a *circuit* with 2 compressors with 3 *capacity steps* can supply up to 8 activation levels/steps).
The requirements for the activation of steps at a level of circuits inside the same *evaporator* are as follows.

3.9.5.3 Circuit saturation

The saturation policy seeks to distribute resources equally to the smallest possible number of circuits, compatibly with the constraints imposed by other requirements, such as: safety times, maximum number of starts in one hour. The resulting allocation is such as to have the largest possible number of circuits non-active at any one time.

3.9.5.4 Circuit balancing

The balancing policy seeks to distribute resources equally to the largest possible number of circuits, compatibly with the constraints imposed by other requirements, such as: safety times, maximum number of starts in one hour. The resulting allocation is such as to have *circuit* output levels equalised as much as possible at any one time.

3.9.6 Evaporator

An *evaporator* is defined as *saturated* when it is at its maximum output (total of the maximum number of power steps deliverable by the circuits belonging to the *evaporator*). An *evaporator* is said to be active or on if at least one *circuit* is activated, and *off* if none of the circuits is on. The activation level of an *evaporator* is understood as the total number of power steps that the circuits are supplying at the time (e.g. an *evaporator* with 2 circuits, and 2 compressors with 3 *capacity steps* per *circuit*, can supply up to 16 activation levels/steps). The requirements for the activation of steps on a level of *evaporator* inside the same system are as follows.

3.9.6.5 Evaporator saturation

The saturation policy seeks to distribute resources to the smallest possible number of evaporators, compatibly with the constraints imposed by other requirements, such as: safety times for compressors, maximum number of starts in one hour. The resulting allocation is such as to have the largest number of evaporators non-active at any one time.

3.9.6.6 Evaporator balancing

The balancing policy seeks to distribute resources equally to the largest possible number of evaporators, compatibly with the constraints imposed by other requirements, such as: safety times, maximum number of starts in one hour. The resulting allocation is such as to have *circuit* output levels equalised as much as possible at any one time.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
240	EV_SELECTION_FUNCTION	Selection of policy for refrigerating capacity resources at *evaporator* level	0...1	1	28	C	V	0=SATURATION, 1=BALANCING	flag
241	CIR_SELECTION_FUNCTION	Selection of policy for refrigerating capacity resources at *circuit* level	0...1	1	29	C	V	0=SATURATION, 1=BALANCING	flag
242	KOMP_SELECTION_FUNCTION	Selection of policy for refrigerating capacity resources at *compressor* level	0...1	0	30	C	V	0=SATURATION, 1=BALANCING	flag

3.10 Compressor management

3.10.1 Compressor configuration

The compressors are configured by setting *parameters* KOMP_CIRC_EV_i to associate ith *compressor* with *:*

- the *circuit* corresponding to the unit value of parameter KOMP_CIRC_EV_i;
- the *evaporator* corresponding to the value plus ten of parameter KOMP_CIRC_EV_i

For example, in the default machine, the *parameters* are set with the values shown in the following table*:*

KOMP_CIR_EV_1	11
KOMP_CIR_EV_2	12
KOMP_CIR_EV_3	21
KOMP_CIR_EV_4	22
KOMP_CIR_EV_5	0
KOMP_CIR_EV_6	0
KOMP_CIR_EV_7	0
KOMP_CIR_EV_8	0

This corresponds to a total of 4 compressors; the first belongs to the first *circuit* of the first *evaporator*, the second to the second *circuit* of the first *evaporator*, the third to the first *circuit* of the second *evaporator*, the fourth to the second *circuit* of the second *evaporator*.

IMPORTANT NOTE: The table must be completed from top to bottom, with values strictly in ascending order.

3.10.2 Compressor timing

The switching on and *off* of a *compressor* must meet the following requirements*:*

- Minimum *Off*-On time (parameter MIN_OFFON_TIME)**.** This is the minimum time that must elapse between one switch *off* and the next start;
- Minimum On-*Off* time (parameter MIN_ONOFF_TIME). This is the minimum time that must elapse between one start and the next switch *off*;

The switching on and *off* a *compressor*'s *capacity steps* must meet the following requirements*:*

- Safety time for power decrement steps (parameter CPWR_UPDOWN_MIN_TIME). This is the minimum time required between switch *off* of *capacity steps* in the same *compressor*.
- Safety time for power increment steps (parameter CPWR_DOWNUP_MIN_TIME). This is the minimum time required between starts of *capacity steps* in the same *compressor*.

The switching on of compressors must meet the following requirement*:*

- Minimum time between start of compressors (parameter SOFTSTART_TIME). This is to ensure that the electrical power line does not undergo the simultaneous starting of several compressors

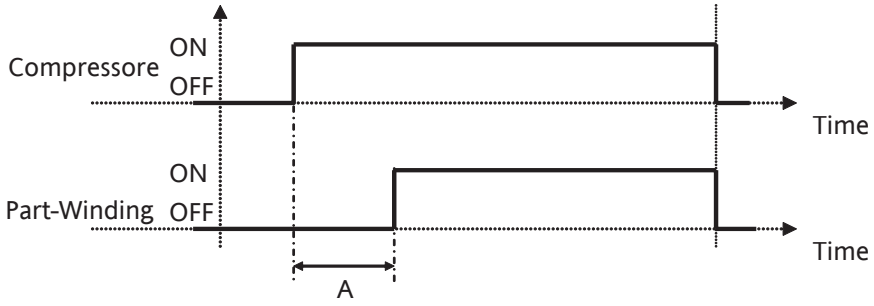
3.10.3 Hours of compressor use

The operating time of the compressors is stored every hour in EEPROM, on the following two *parameters :*

- KOMP_USAGE_DAYS_i, days of ith *compressor* use
- KOMP_USAGE_HOUR_i, hours of use of ith *compressor*

3.10.4 Part-winding start

Each *compressor* is associated with a relay used to limit current peaks at *compressor* activation and whose operation is described in the Figure



Compressor	KOMP_ACC_DO_i_PHY, i=ith *compressor*;
Part-winding	KOMP_PW_DO_i_PHY, i=ith *compressor*;
A	PAR_TMR_BIOS_2

3.10.5 Capacity steps

A system with power modulated compressors is defined with *parameters* KOMP_STAGE_i, i=ith *compressor*. If KOMP_STAGE_i =0, the system does not manage part loading compressors. Alternatively, parameter KOMP_STAGE_i must be set with the number of *capacity steps* of each ith *compressor*.
Parameter KOMP_TYPE defines the actuation mode for the *capacity steps*

Parameter	Explanation
KOMP_STAGE_i	Selection of number of power divisions of the ith *compressor*
KOMP_TYPE	Capacity step actuation mode: SEMI-HERMETIC SCREW

KOMP_STAGE_i=0

No *capacity steps* are provided for, therefore the *compressor* can deliver 0% or 100% of its power.

KOMP_STAGE_i=1 (2 temperature *control* steps)

1 capacity step is provided for, therefore the *compressor* can deliver 0%, 50% or 100% of its power.

Power	ACC	Semi-hermetic			Screw		
		PARZ 1	PARZ 2	PARZ 3	PARZ 1	PARZ 2	PARZ 3
100%	ON						
50%	ON	ON			ON		
0%							

KOMP_STAGE_i=2 (3 temperature *control* steps)

2 *capacity steps* are provided for, therefore the *compressor* can deliver 0%, 33%, 66% or 100% of its power.

Power	ACC	Semi-hermetic			Screw		
		PARZ 1	PARZ 2	PARZ 3	PARZ 1	PARZ 2	PARZ 3
100%	ON						
66%	ON		ON			ON	
33%	ON	ON	ON		ON		
0%							

KOMP_STAGE_i=3 (4 temperature *control* steps)

3 *capacity steps* are provided for, therefore the *compressor* can deliver 0%, 25%, 50%, 75% or 100% of its power.

Power	ACC	Semi-hermetic			Screw		
		PARZ 1	PARZ 2	PARZ 3	PARZ 1	PARZ 2	PARZ 3
100%	ON						
75%	ON			ON			ON
50%	ON		ON	ON		ON	
25%	ON	ON	ON	ON	ON		
0%							

ACC	KOMP_ACC_DO_i_PHY, i=ith *compressor*
PARZ1	KOMP_PARZ1_DO_i_PHY, i=ith *compressor*
PARZ2	KOMP_PARZ2_DO_i_PHY, i=ith *compressor*
PARZ3	KOMP_PARZ3_DO_i_PHY, i=ith *compressor*

3.10.6 Compressor selection

Compressors can be deselected individually using the *parameters* KOMP_SELEZ_i_HOT, with i=ith *compressor*. Deselection involves*:*

- zero setting of *compressor availability*
- zero setting of all its possible alarms.
- Its alarms are not managed

3.10.7 Maximum number of starts per hour

Parameter MAX_STARTS_PER_HOUR_NO defines the maximum number of starts allowed for the *compressor* in one hour. When the maximum number of starts in the last hour reaches this value, the *availability* of this *compressor* is zero set.
The number of starts is stored with a time resolution of 3600/32 seconds.
The *compressor* will become available again only when the number of starts stored in the last hour becomes less than MAX_STARTS_PER_HOUR_NO. This will occur with certainty when the oldest start took place more than one hour before.
The number of starts is always zero set *:*

- when changing from on to *off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting from configuration mode;

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
200	KOMP_CIR_EV_1	Association of *compressor* 1 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	11...24	11	0	C	V		num
201	KOMP_CIR_EV_2	Association of *compressor* 2 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	12	0	C	V		num
202	KOMP_CIR_EV_3	Association of *compressor* 3 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	21	0	C	V		num
203	KOMP_CIR_EV_4	Association of *compressor* 4 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	22	0	C	V		num
204	KOMP_CIR_EV_5	Association of *compressor* 5 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
205	KOMP_CIR_EV_6	Association of *compressor* 6 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
206	KOMP_CIR_EV_7	Association of *compressor* 7 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
207	KOMP_CIR_EV_8	Association of *compressor* 8 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
210	KOMP_STAGE_1	Number of *capacity steps* of *compressor* 1	0...3	2	0	C	V		num
211	KOMP_STAGE_2	Number of *capacity steps* of *compressor* 2	0...3	2	0	C	V		num
212	KOMP_STAGE_3	Number of *capacity steps* of *compressor* 3	0...3	2	0	C	V		num
213	KOMP_STAGE_4	Number of *capacity steps* of *compressor* 4	0...3	2	0	C	V		num
214	KOMP_STAGE_5	Number of *capacity steps* of *compressor* 5	0...3	2	0	C	V		num
215	KOMP_STAGE_6	Number of *capacity steps* of *compressor* 6	0...3	2	0	C	V		num
216	KOMP_STAGE_7	Number of *capacity steps* of *compressor* 7	0...3	2	0	C	V		num
217	KOMP_STAGE_8	Number of *capacity steps* of *compressor* 8	0...3	2	0	C	V		num
218	KOMP_TYPE	*Compressor* type. It intervenes on the way of actuating the activation/deactivation sequence of the relays associated with the *compressor capacity steps*.	0...1	0	12	C	V	0=SEMI-HERMETIC, 1=SCREW	num
2F0	MIN_OFFON_TIME _HOT	*Compressor* safety time from *OFF* to ON	0...500	60	0	H	V		sec
2F1	MIN_ONOFF_TIME _HOT	*Compressor* safety time from ON to *OFF*	0...500	10	0	H	V		sec
2F2	MAX_STARTS_PER_HOUR_NO _HOT	Maximum number of *compressor* starts in one hour	0...20	6	0	H	V		num
2F3	CPWR_UPDOWN_MIN_TIME_H OT	Safety time for power decrement steps	0...300	10	0	H	V		sec
2F4	CPWR_DOWNUP_MIN_TIME_H OT	Safety time for power increment steps	0...300	10	0	H	V		sec
320	KOMP_SELEZ_1_HOT	Select *compressor* 1	0...1	1	6	H	V	0=NO, 1=YES	flag
321	KOMP_SELEZ_2_HOT	Select *compressor* 2	0...1	1	6	H	V	0=NO, 1=YES	flag
322	KOMP_SELEZ_3_HOT	Select *compressor* 3	0...1	1	6	H	V	0=NO, 1=YES	flag
323	KOMP_SELEZ_4_HOT	Select *compressor* 4	0...1	1	6	H	V	0=NO, 1=YES	flag
324	KOMP_SELEZ_5_HOT	Select *compressor* 5	0...1	1	6	H	V	0=NO, 1=YES	flag
325	KOMP_SELEZ_5_HOT	Select *compressor* 6	0...1	1	6	H	V	0=NO, 1=YES	flag
326	KOMP_SELEZ_7_HOT	Select *compressor* 7	0...1	1	6	H	V	0=NO, 1=YES	flag
327	KOMP_SELEZ_8_HOT	Select *compressor* 8	0...1	1	6	H	V	0=NO, 1=YES	flag
330	KOMP_USAGE_DAYS_1	Days of use of *compressor* 1	0...32000	0	0	C	V		day
331	KOMP_USAGE_DAYS_2	Days of use of *compressor* 2	0...32000	0	0	C	V		day
332	KOMP_USAGE_DAYS_3	Days of use of *compressor* 3	0...32000	0	0	C	V		day

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
333	KOMP_USAGE_DAYS_4	Days of use of *compressor* 4	0...32000	0	0	C	V		day
334	KOMP_USAGE_DAYS_5	Days of use of *compressor* 5	0...32000	0	0	C	V		day
335	KOMP_USAGE_DAYS_6	Days of use of *compressor* 6	0...32000	0	0	C	V		day
336	KOMP_USAGE_DAYS_7	Days of use of *compressor* 7	0...32000	0	0	C	V		day
337	KOMP_USAGE_DAYS_8	Days of use of *compressor* 8	0...32000	0	0	C	V		day
338	KOMP_USAGE_HOUR_1	Hours of use of *compressor* 1	0...24	0	0	C	V		hour
339	KOMP_USAGE_HOUR_2	Hours of use of *compressor* 2	0...24	0	0	C	V		hour
33A	KOMP_USAGE_HOUR_3	Hours of use of *compressor* 3	0...24	0	0	C	V		hour
33B	KOMP_USAGE_HOUR_4	Hours of use of *compressor* 4	0...24	0	0	C	V		hour
33C	KOMP_USAGE_HOUR_5	Hours of use of *compressor* 5	0...24	0	0	C	V		hour
33D	KOMP_USAGE_HOUR_6	Hours of use of *compressor* 6	0...24	0	0	C	V		hour
33E	KOMP_USAGE_HOUR_7	Hours of use of *compressor* 7	0...24	0	0	C	V		hour
33F	KOMP_USAGE_HOUR_8	Hours of use of *compressor* 8	0...24	0	0	C	V		hour

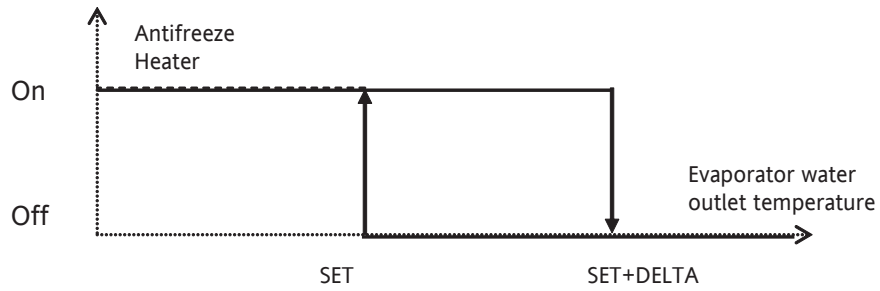
3.11 Antifreeze

3.11.1 Antifreeze function

If the machine is:

- started in *cooling mode* (or going *off* from *cooling mode*) and parameter AFPR_COOLING_ENABLED_FLAG=yes;
- started in *heating mode* (or going *off* from *heating mode*) and parameter AFPR_HEATING_ENABLED_FLAG=yes;
- started in *heating mode* and at least one *circuit* of the machine is defrosting with the compressors on and parameter AFPR_ENABLED_DURING_*DEFROST*=yes;
- machine *off* and parameter AFPR_*OFF*_STDBY_ENABLE_FLAG=yes (in this case the *parameters* of the heating or *cooling mode* currently selected will be used)

The controller enables an algorithm to prevent the *antifreeze alarm*s from monitoring the outlet temperature at each *evaporator*. This algorithm activates the *antifreeze* heaters according to the hysteresis function with setting AFPR_CHILLING_TSET/ AFPR_HEATING_TSET and Delta AFPR_DELTA_TEMP as shown in the figure.



SET	AFPR_CHILLING_TSET/ AFPR_HEATING_TSET
DELTA	AFPR_DELTA_TEMP
Water temperature at *evaporator* outlet	EV_TEMP_OUTWATER_SENS_i_PHY, i = ith *evaporator*
Antifreeze heater	EV_HEATER_DO_i_PHY, i = ith *evaporator*

In particular, the *antifreeze* heater is On if water temperature < SET, *Off* if water temperature >= (SET+DELTA), and unchanged in the other cases.

If at least one *evaporator* requires its *antifreeze* heater to be switched on, the *antifreeze* heaters of all the evaporators will be switched on.
The *antifreeze* heaters are always *off* when in configuration mode, or in case of *evaporator outlet water sensor error*, or if there is an *antifreeze alarm* with parameter AF_USE_RESISTOR_FLAG set to NO.
The hysteresis function is always reinitialised at Power On, when system status changes from *Off* to cooling, and when exiting configuration mode.

Errors in this sensor cause the system "block" (including pumps and *antifreeze* heaters).

Note: Activation of the heaters causes a request for activation of one of the pumps in the *pump* group in order to allow water to circulate in the primary *circuit*.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
2C0	AFPR_COOLING_ENABLED_FLAG	Enable *antifreeze* prevention function if the system is on or going *off* (in *Cooling mode* or Going *Off*)	0...1	1	6	C	V	0=NO, 1=YES	flag
2C1	AFPR_*OFF*_STDBY_ENABLE_FLAG	Enable *antifreeze* prevention function if the system is *off* (*Off* mode)	0...1	1	6	C	V	0=NO, 1=YES	flag
2C2	AFPR_CHILLING_TSET	*Antifreeze* prevention setpoint	-50.0...150.0	5.0	0	C	V		°C
2C3	AFPR_DELTA_TEMP	*Antifreeze* prevention delta	-50.0...150.0	2.0	0	C	V		°C
2C4	AFPR_ENABLED_DURING_*DEFROST*	Enable *antifreeze* prevention if the system is defrosting	0...1	0	6	C	V	0=NO, 1=YES	Flag
2C5	AFPR_ENABLED_DURING_HEATING	Enable *antifreeze* prevention function if the system is on or going *off* in *heating mode*	0...1	0	6	C	V	0=NO, 1=YES	Flag
2C6	AFPR_HEATING_TSET	*Antifreeze* prevention setpoint in *heating mode*	-50.0...150.0	5.0	0	C	V		°C

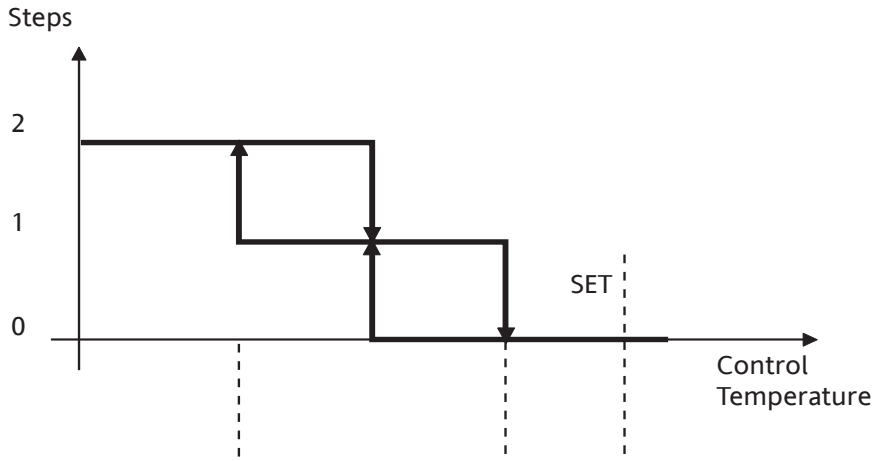
3.12 Integrated heater

The *integrated heater*s are used in heat production systems (Heat Pumps) to increase the heat production capacity, especially during the system start phase. The *integrated heater*s on the *evaporator* in a Heat *Pump* system are physically the same heaters as those used for the *Antifreeze function*.
The use of the *integrated heater*s is enabled by the INTH_ENABLE_FLAG parameter, and the related controller operates according to the primary *circuit* inlet water temperature.
The heaters can be activated only if *:*

- the machine is not *off*;
- the parameter INTH_ENABLE_FLAG=TRUE;
- there are no errors in the primary *circuit* inlet water temperature sensor;

In the above conditions, if the inlet water temperature of the *circuit* is below HP_TSET_TEMP – INTH_DISPATCH_TEMP – INTH_PROPORTIONAL_BAND, all the heaters are switched on.

They are switched *off* if the temperature exceeds HP_TSET_TEMP – INTH_DISPATCH_TEMP. For other temperatures, *control* is proportional in steps as described below*:*



SET	HP_TSET_TEMP
DELTA	INTH_DISPATCH_TEMP
BAND	INTH_PROP_BAND
Control temperature	PLAN_TEMP_INWATER_SENS
Steps	Number of heaters On requested

They are started in a fixed order.
The above drawing shows an example with two evaporators where, if activation of only one step is requested, EV_HEATER_DO_1_PHY alone is switched on, and if activation of two steps is requested, EV_HEATER_DO_1_PHY and EV_HEATER_DO_2_PHY are switched on.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
4C0	INTH_ENABLE_FLAG	Enable integration function	0...1	1	6	C	V	0=NO, 1=YES	flag
4C1	INTH_DISPATCH_TEMP_HOT	Temperature Delta for activating *integrated heater*s	-10.0...10.0	2.0	0	H	V		°C
4C2	INTH_PROP_BAND_HOT	Proportional band for activating *integrated heater*s	0.0...30.0	5	0	H	V		°C

3.13 Management ON/OFF

The machine operating status can have one of the following three values:

- *OFF*
- ON (in cooling/*heating mode*)
- SWITCH *OFF*

Operation status can be modified by the user from keypad (PUSH: ON/*OFF*), dedicated digital input PLAN_ONOFF_DI_PHY if enabled by parameter PLAN_ONOFF_DI_ENABLE_FLAG or by the current time band settings if TIME_BAND_ENABLE_FLAG_HOT=YES. When selected from keypad, system operation status is stored in EEPROM to reinstate it :

- at the next Power On (after a power failure);
- when the management of time bands and remote ON/*OFF* digital input are both disabled;
- or when *time band management* is disabled and remote ON/*OFF* digital input status changes from TRUE-> FALSE with PLAN_ONOFF_DI_ENABLE_FLAG=YES;

If enabled, the remote ON/*OFF* digital input always has priority and, when PLAN_ONOFF_DI_PHY=true, causes machine switch *off* if on, or keeps it *off*. If PLAN_ONOFF_DI_PHY=false or if PLAN_ONOFF_DI_ENABLE_FLAG=NO, system switch On/*Off* is controlled from the current *time band mode* if TIME_BAND_ENABLE_FLAG_HOT=YES, otherwise it is controlled from keypad with the ON/*OFF* button
(toggle function). Note that the switch *off* phase cannot be stopped by an ON/*OFF* request from the keypad, which is therefore ignored.

The following table gives some particular conditions for changes of system status in relation to *pump* start and switch *off* delays. *Time band management* is assumed as disabled and the remote ON/*OFF* digital input enabled.

	Active status	Status in EEPROM	Timer 1	Timer 2	Remote ON/*OFF*	
A	On	On	Not active	Not active	False->True	the system changes to switch *off*
B	On	On	Active	Not active	False->True (*)	the system changes to switch *off* mode and Timer 2 is restarted
C	Switch *off*	On	Not active	Not active	True->False	the system starts instantly (the temperature controller resumes *control* of resources)
D	Switch *off*	On	Not active	On	True->False	the system starts and Timer 2 is restarted (the compressors remain *off* until Timer 1 stops and are then controlled by the temperature controller).

Timer 1	PUMPGROUR_STARTUP_DELAY_TIME
Timer 2	PUMPGROUR_STOP_DELAY_TIME
Remote ON/*OFF*	PLAN_ON_DI_PHY

(*) or the ON/*OFF* button is pressed

Machine operating status changes from SWITCH *OFF* to *OFF* when all compressors are *off*, the *pump* is *off* and dripping has ended (if *defrost* was active).

Note In case of a power failure during the machine switch *off* phase, the machine restarts from *Off* at the next Power On.

3.14 Mode change management (SUMMER/WINTER)

If *time band management* is not enabled, summer/winter switchover (mode change) can occur by digital input PLAN_MODE_DI_PHY if enabled by parameter PLAN_MODE_DI_ENABLE_FLAG or from keypad by modifying parameter PLAN_MODE_MANUAL_HOT. If *time band management* is enabled (TIME_BAND_ENABLE_FLAG_HOT=YES) and the current band mode is *PUMP* or *CHILLER* the mode is always that set in the time band.
The digital input has priority over the parameter PLAN_MODE_MANUAL_HOT.
Mode change can occur with the machine *off* or on: in the latter case, the machine switches *off* automatically and then restarts in the new mode.
In both cases, i.e. with machine on or *off*, every machine status and all alarms are reinitialised with mode change.
Once activated, the mode change procedure cannot be stopped by another mode change. The machine will therefore go *off* in the current mode, enter the last mode selected, then restart (unless *off* is requested by digital input or by the status in EEPROM). Therefore, if machine *off* is requested (e.g. by digital input) during a mode change procedure, when the machine goes *off*, the reverse cycle valves will assume the status of the last mode selected, and the machine will remain *off*.

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of transcoding	UM
223	PLAN_MODE_DI_ENABLE_FLAG	Enable operating mode setting from digital input	0..1	1	6	C	V	0=NO, 1=YES	flag
224	PLAN_ONOFF_DI_ENABLE_FLAG	Enable remote ON-*OFF* from digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
249	PLAN_MODE_MANUAL_HOT	Summer/winter mode from keypad	0...1	0	27	H	V	0=*CHILLER*, 1=HEATPUMP	flag

4 STORICO ALLARMI

The alarms history is enabled by the parameter HISTORY_ENABLE_FLAG. Disabling does not erase it. To do this, please refer to the related section.
The alarms indicated in the section ***LIST OF ALARMS AND THEIR IDENTIFICATION CODES*** are saved in a circular queue (FIFO) in non-volatile memory, which can contain up to 50 elements.
When a new alarm is activated it is immediately entered in the history. If the alarm is already present in the history and occurred in the same hour, its hourly frequency is increased. The maximum value of the hourly frequency is 99. If there are at least 50 elements in the queue, the activation of a new alarm causes the data relevant to the oldest alarm to be erased.
The following data is stored for each alarm:

- Alarm identification code (xy) and system index (zw): Exyzw
- Activation hour: hh
- Activation date: dd/mm/yy
- Hourly frequency, i.e. number of activations in hour (max. 99)

E.g.: E0601-13-12/04/05-01

4.1 List of alarms and their identification codes

Alarms list	Alarm code	System index
Inlet water temperature sensor error	00	00
Outlet water temperature sensor error	01	00
Dynamic setpoint current sensor error	02	00
System hightemperature alarm	03	00
System *low temperature alarm*	04	00
Circuit maximum pressure sensor error	05	01...04
Circuit maximum pressure alarm	06	01...04
Circuit minimum pressure alarm	07	01...04
Compressor discharge temperature sensor error	08	01...04
Compressor thermal protection alarm	09	01...04
Compressor discharge temperature alarm	10	01...04
Pump thermal protection alarm	11	01...02
Flow switch automatic and/or blocking alarm	12	00
Fan battery thermal protection alarm	13	01...02
Evaporator outlet water temperature sensor error	14	01...02
Evaporator antifreeze alarm	15	01...02
Condenser temperature sensor error	16	01...04

Therefore, for example, the maximum pressure alarm of *circuit* 3 will have identification code: E0603

4.2 Display alarms history

The alarms history can be displayed using the keypad and the special menu. When first opened, the oldest alarm in the history (with list number 1) is shown. Press the ENTER key on the keypad to scroll the stored alarms to the most recent. The list number of the last alarm stored will be the number of alarms stored. The number of alarms stored is shown on the right of the list number of the alarm displayed. If the history display menu is opened after already browsing it, and in the meantime a new alarm has been entered, thus "shifting" the place of the alarm in the list, the display will show the alarm with updated list number.

4.3 Unloading alarms history with serial command

The alarms history can be unloaded with a serial command by reading string-type *parameters* E2_HISTORY_1 to E2_HISTORY_50. Parameter E2_HISTORY_NUM indicates the number of alarms in the history, whereas the parameter E2_HISTORY_OLDEST gives the number (starting from 0) of the oldest alarm in the queue.
If E2_HISTORY_NUM is less than 50, e.g. 7, just read strings E2_HISTORY_1 to E2_HISTORY_6 to unload the history completely.
If E2_HISTORY_NUM is 50 and, for example, E2_HISTORY_OLDEST is 7, just read strings E2_HISTORY_7 to E2_HISTORY_50 and E2_HISTORY_1 to E2_HISTORY_6 to unload the history completely and have the alarms in the correct order of time (from oldest to most recent).
To prevent new alarms being entered in the history during the unloading process, the history function must be temporarily disabled. This is done by setting the HistoryReqLocked variable (Modbus address 624) to 1 and waiting for the application to set the HistoryLocked variable (Modbus address 623) to 1. The blackbox can now be unloaded. Afterwards, the HistoryReqLocked variable must be reset in order to "unlock" the alarms history. The application indicates that the history has been "unlocked" by resetting the HistoryLocked variable. In any case, the HistoryReqLocked and HistoryLocked variables are automatically reset by the application if the HistoryReqLocked variable is not

reset within 60sec (maximum time allowed for unloading the alarms history). For the serial commands, refer to the relevant manual.

4.4 Erasing the alarms history

The alarms history can be erased using the keypad, by selecting the “Erase History” item from the Alarms menu. With a serial command, set the VAR_BOO_BIOS_37 variable to 1. The variable will be reset by the application.

Modbus address (hex)	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	UM
6F0	E2_HISTORY_OLDEST_HOT	Gives the index (starting from 0) of the oldest alarm. If the number of alarms entered is less than 50, the index remains at 0.	0...49	0	0	H	N		num
6F1	E2_HISTORY_NUM_HOT	Number of alarms entered in the alarms history. If zero, it is empty. If 50, the history is full.	0...50	0	0	H	N		num
6F2	E2_HISTORY_1_HOT	Alarm history 20-character string with position 0. For example, if E2_HISTORY_OLDEST is 0 and E2_HISTORY_NUM is not 0, this string represents the oldest alarm	x...x	(*)	7	H	V		x
6F3...	E2_HISTORY_2_HOT	20-character alarm history position 1. For example, if E2_HISTORY_OLDEST is 1 and E2_HISTORY_NUM is not 0, this string represents the oldest alarm	x...x	(*)	7	H	V		x
....	....	....	....						
723	E2_HISTORY_50_HOT	Alarm history 20-character string with position 49. For example, if E2_HISTORY_OLDEST is 49 and E2_HISTORY_NUM is not 0, this string represents the oldest alarm	x...x	(*)	7	H	V		x
729	HISTORY_ENABLE_FLAG	Enable alarm history	0...1	0	6	C		0=NO; 1=YES	flag

(*) The default value is "-------EMPTY--------"

5 SCATOLA NERA

5.1 General

Function used, in case of an event, to record machine operation status in the form of a file in non-volatile memory. The events that cause storing are as follows:

- a manual reset alarm occurs;
- a bounded-type alarm changes from automatic to manual.

When a new event is being diagnosed, any other event is ignored until the complete collection has been stored. The maximum number of collections is three. The three collections present are always the most recent, according to a circular queue logic.

5.2 Parameters available

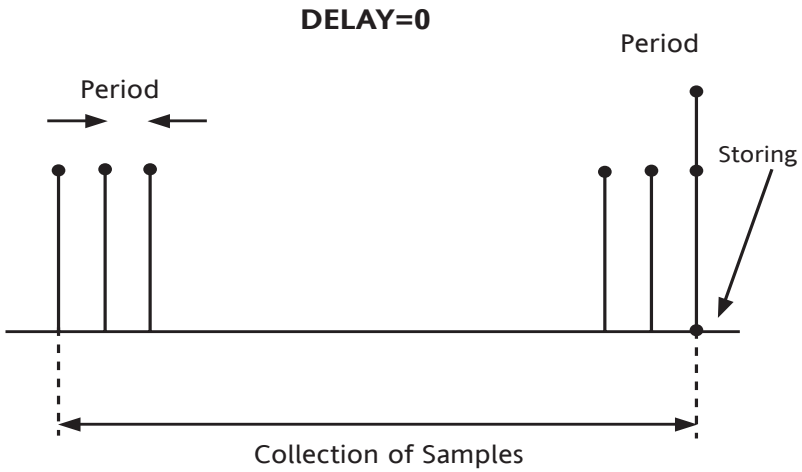
- BBX_ENABLE_FLAG — enable blackbox function [0,1]. Disabling this function does not delete the collections already stored, but allows resetting of the alarms specific to the blackbox and resetting of the circular queue for samples in RAM
- BBX_INTERVAL_TIME — Sampling interval for blackbox [60sec,250sec]
- BBX_DELAY — Delay for storing samples for the blackbox [0.20]

The number of samples (NUMERO CAMPIONI) for each collection is fixed at 20.

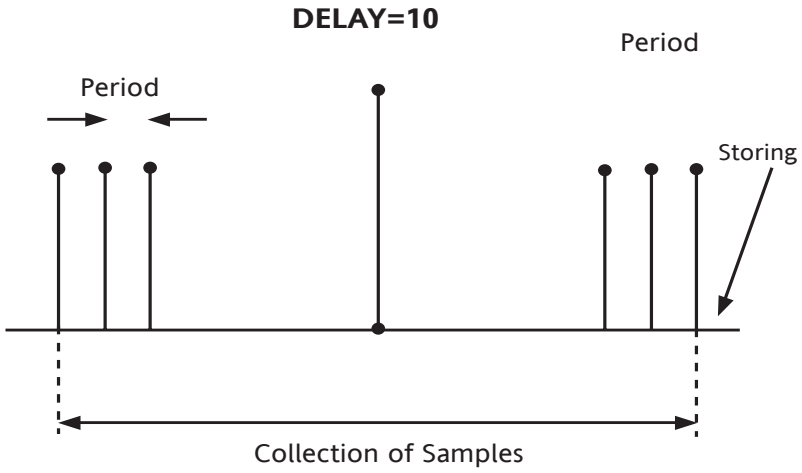
The collection of samples (NUMERO CAMPIONI) is continuously updated in a circular queue in RAM, at frequency 1/BBX_INTERVAL_TIME. When an event occurs, the whole collection is stored in non-volatile memory in the form of a file with a delay selectable according to parameter BBX_DELAY.

The following diagrams give a few examples of storing according to the parameter BBX_DELAY.

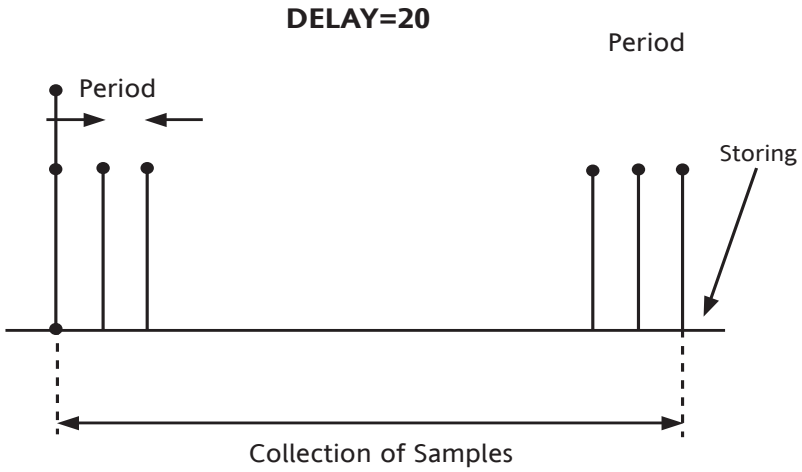
The collection of samples (NUMERO CAMPIONI) is entirely stored when an event occurs (BBX_DELAY=0):



The collection of samples (NUMERO CAMPIONI)/2 is stored after the event has occurred (BBX_DELAY=10):



The collection of samples (NUMERO CAMPIONI) is stored after the event has occurred (BBX_DELAY=20):



5.3 Description of the collections stored

The collection of data stored for the event consists of a HEADER and a number of data samples (NUMERO CAMPIONI).

The HEADER consists of:

Value read	Number of characters for value	Description
BbxCode	2	Alarm identification code
'/'	1	Separator
BbxIdx	1	System index
'/'	1	Separator
BbxDateAndTime	20	Date and time
'/'	1	Separator
BBX_DELAY	3	Collection storing delay
'/'	1	Separator
BBX_INTERVAL_TIME	2	Sampling time for samples in RAM
'/'	1	Separator
BbxCurrentIndex	2	Index of oldest sample in the collection
'/'	1	Separator
BbxNum	2	Number of samples in the collection

is of fixed size.

The alarm identification code and system index are given in:

Alarms list	Alarm code	System index
System *high temperature alarm*	03	00
System *low temperature alarm*	04	00
Circuit maximum pressure alarm	06	01...04
Circuit minimum pressure alarm	07	01...04
Compressor thermal protection alarm	09	01...04
Compressor discharge temperature alarm	10	01...04
Pump thermal protection alarm	11	01...02
Flow switch automatic and/or blocking alarm	12	00
Ventilating battery thermal protection alarm	13	01...02
Evaporator antifreeze alarm	15	01...02

The SAMPLES consist of:

Value read	Number of characters for value
PLAN_ON_DI_PHY	1
PLAN_MODE_DI_PHY	1
CIR_PRES_MAX_DI_1_PHY	1
CIR_PRES_MIN_DI_1_PHY	1
CIR_PRES_MAX_DI_2_PHY	1
CIR_PRES_MIN_DI_2_PHY	1
CIR_PRES_MAX_DI_3_PHY	1
CIR_PRES_MIN_DI_3_PHY	1
CIR_PRES_MAX_DI_4_PHY	1
CIR_PRES_MIN_DI_4_PHY	1
KOMP_A_THER_DI_1_PHY	1
KOMP_A_THER_DI_2_PHY	1
KOMP_A_THER_DI_3_PHY	1
KOMP_A_THER_DI_4_PHY	1
*FANS*_A_THER_DI_1_PHY	1
*FANS*_A_THER_DI_2_PHY	1
*PUMP*_A_FLOW_DI_PHY	1
*PUMP*_A_THER_DI_1_PHY	1
*PUMP*_A_THER_DI_2_PHY	1
'/'	1
PLAN_CUMALARM_DO_PHY	1
EV_HEATER_DO_1_PHY	1
EV_HEATER_DO_2_PHY	1
CIR_SOLENOID_VALVE_DO_1_PHY	1
CIR_INVERSION_VALVE_DO_1_PHY	1
CIR_SOLENOID_VALVE_DO_2_PHY	1
CIR_INVERSION_VALVE_DO_2_PHY	1
CIR_SOLENOID_VALVE_DO_3_PHY	1
CIR_INVERSION_VALVE_DO_3_PHY	1
CIR_SOLENOID_VALVE_DO_4_PHY	1
CIR_INVERSION_VALVE_DO_4_PHY	1
KOMP_ACC_DO_1_PHY	1
KOMP_PW_DO_1_PHY	1
KOMP_PARZ1_DO_1_PHY	1
KOMP_PARZ2_DO_1_PHY	1
KOMP_PARZ3_DO_1_PHY	1
KOMP_ACC_DO_2_PHY	1
KOMP_PW_DO_2_PHY	1
KOMP_PARZ1_DO_2_PHY	1
KOMP_PARZ2_DO_2_PHY	1
KOMP_PARZ3_DO_2_PHY	1
KOMP_ACC_DO_3_PHY	1
KOMP_PW_DO_3_PHY	1
KOMP_PARZ1_DO_3_PHY	1
KOMP_PARZ2_DO_3_PHY	1
KOMP_PARZ3_DO_3_PHY	1
KOMP_ACC_DO_4_PHY	1
KOMP_PW_DO_4_PHY	1
KOMP_PARZ1_DO_4_PHY	1
KOMP_PARZ2_DO_4_PHY	1
KOMP_PARZ3_DO_4_PHY	1

Value read	Number of characters for value
KOMP_IL_DO_1_PHY	1
KOMP_IL_DO_2_PHY	1
KOMP_IL_DO_3_PHY	1
KOMP_IL_DO_4_PHY	1
*FANS*_ACC1_DO_1_PHY	1
*FANS*_ACC2_DO_1_PHY	1
*FANS*_ACC3_DO_1_PHY	1
*FANS*_ACC4_DO_1_PHY	1
*FANS*_ACC1_DO_2_PHY	1
*FANS*_ACC2_DO_2_PHY	1
*FANS*_ACC3_DO_2_PHY	1
*FANS*_ACC4_DO_2_PHY	1
*PUMP*_ACC_DO_1_PHY	1
*PUMP*_ACC_DO_2_PHY	1
'/'	1
PLAN_TEMP_INWATER_SENS_PHY	5
PLAN_TEMP_OUTWATER_SENS_PHY	5
PLAN_CURR_DTSET_SENS_PHY	5
EV_TEMP_OUTWATER_SENS_1_PHY	5
EV_TEMP_OUTWATER_SENS_2_PHY	5
CIR_PRES_MAX_SENS_1_PHY	5
CIR_PRES_MAX_SENS_2_PHY	5
CIR_PRES_MAX_SENS_3_PHY	5
CIR_PRES_MAX_SENS_4_PHY	5
KOMP_TEMP_DISCHARGE_SENS_1_PHY	5
KOMP_TEMP_DISCHARGE_SENS_2_PHY	5
KOMP_TEMP_DISCHARGE_SENS_3_PHY	5
KOMP_TEMP_DISCHARGE_SENS_4_PHY	5
'/'	1
*FANS*_CTRL_AO_1_PHY	3
*FANS*_CTRL_AO_2_PHY	3
'/'	1
PlanTempInWaterSensErr	1
PlanTempOutWaterSensErr	1
PlanCurrDtsetSensErr	1
PlanHTempA	1
PlanLTempA	1
CirPresMaxSensErr[0]	1
CirHPrA[0]	1
CirLPrA[0]	1
CirPresMaxSensErr[1]	1
CirHPrA[1]	1
CirLPrA[1]	1
CirPresMaxSensErr[2]	1
CirHPrA[2]	1
CirLPrA[2]	1
CirPresMaxSensErr[3]	1
CirHPrA[3]	1
CirLPrA[3]	1
KompTempDischargeSensErr[0]	1
KompTherA[0]	1

Value read	Number of characters for value
KompDisA[0]	1
KompTempDischargeSensErr[1]	1
KompTherA[1]	1
KompDisA[1]	1
KompTempDischargeSensErr[2]	1
KompTherA[2]	1
KompDisA[2]	1
KompTempDischargeSensErr[3]	1
KompTherA[3]	1
KompDisA[3]	1
PumpTherA[0]	1
PumpTherA[1]	1
FlowA	1
FansTherA[0]	1
FansTherA[1]	1
EvTempOutWaterSensErr[0]	1
EvAfA[0]	1
EvTempOutWaterSensErr[1]	1
EvAfA[1]	1
'/'	1
VAR_BOO_BIOS_1	1
VAR_BOO_BIOS_2	1
VAR_BOO_BIOS_3	1
VAR_BOO_BIOS_4	1
VAR_BOO_BIOS_5	1
'/'	1
TregReqLev	3
PlanMode	1
PlanStatus	1
EvStatus[0]	1
EvStatus[1]	1
CirStatus[0]	1
CirStatus[1]	1
CirStatus[2]	1
CirStatus[3]	1
KompStatus[0]	1
KompSelez[0]	1
KompStatus[1]	1
KompSelez[1]	1
KompStatus[2]	1
KompSelez[2]	1
KompStatus[3]	1
KompSelez[3]	1
FanStatus[0]	1
FanStatus[1]	1
PumpGStatus	1

The size varies according to the machine structural configuration *parameters*. The one shown corresponds to the sample for the maximum machine.

The following is an example of a collection file with a HEADER and 20 samples.

```
15/1/   06/12/05 10:22  /0/60000/16/20
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
0000000000000000000/000101010100000000000000000000000000000000000/0  0  0  70  70  0  0  0  0  0  0  0  0   /0  0  /00000000000000000000000000000000000000/00000/0  0000000001010101000
```

5.4 Unloading files in the blackbox by serial

Each collection is stored in a file. The maximum number of collections is three, corresponding to the file names 000.txt, 001.txt and 002.txt.
Parameter E2_BBX_FILE_NUM indicates the number of collections present in the blackbox, whereas parameter E2_BBX_FILE_OLDEST gives the index (starting from 0 -> 000.txt, 1->001.txt and 2->002.txt) of the oldest collection in the blackbox queue if the blackbox is recycling (E2_BBX_FILE_NUM = 3). Otherwise it must not be considered, since the oldest file is 000.txt.
If E2_BBX_FILE_NUM is less than 3, e.g. 2, it is only necessary to read files 000.txt and 001.txt in order to unload the blackbox completely.
If E2_BBX_FILE_NUM is 3, and E2_BBX_FILE_OLDEST, for example, is 1, the three files must be read in the sequence 001.txt, 002.txt and 000.txt in order to unload the blackbox completely.
To prevent new collections being entered in the blackbox during unloading, the history function must be temporarily disabled. This is done by setting the variable BbxReqLocked (Modbus address 626) to 1 and waiting for the application to set the BbxLocked variable (Modbus address 625) to 1. The blackbox can now be unloaded. Afterwards, the BbxReqLocked variable must be reset in order to “unlock” the blackbox. The application indicates that the blackbox has been “unlocked” by resetting the BbxLocked variable. In any case, the BbxReqLocked and BbxLocked variables are reset automatically by the application if the BbxReqLocked variable is not reset within 180sec (maximum time allowed for unloading the three files from the blackbox). For the serial commands, please refer to the manual concerned.

5.5 Erasing the blackbox

The blackbox can be erased (all three files) using the keypad, by selecting the “Erase blackbox” item from the alarms menu. With a serial command, set the VAR_BOO_BIOS_39 variable to 1. The variable will be reset by the application. Erasing of the blackbox is independent of the blackbox enable parameter and will occur only after possible current storing. This also resets the specific blackbox alarms.

5.6 Alarms specific to the blackbox

Since the collections are stored like files, one of the following file management errors may occur, generating the following automatic alarms:

- File opening error
- File write error
- File closing error

Modbus address (hex)	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
724	E2_BBX_FILE_OLDEST_HOT	Represents the index of the oldest collection (starting from 0) if the blackbox is recycling. If the number of collections present is less than 3, it must not be considered, since the oldest file is always 000.txt.	0...2	0	0	H	N		num
725	E2_BBX_FILE_NUM_HOT	Number of collections entered in the blackbox. If zero, the blackbox is empty. If 3, it is full.	0...3	0	0	H	N		num
726	BBX_ENABLE_FLAG	Enable blackbox	0...1	0	6	C	V		flag
727	BBX_INTERVAL_TIME	Sampling interval for blackbox	60...250	60	11	C	V		sec
728	BBX_DELAY	Delay for storing on samples for blackbox	0...20	0	0	C	V		num

6 DEFROST

The *defrost* function is active only in *heating mode*, and is used to prevent ice forming on the surface of the evaporation element, which occurs most frequently when the ambient temperature is very low, considerably reducing thermodynamic efficiency and creating a risk of damage to the machine.

6.1 Types of defrost

Defrost can be carried out with cycle reversing in a single mode called “Standard”.
This is the same as that implemented in the ECH400 device and is enabled by setting parameter DF_FUNCTION to “Standard”. The *defrost* function can be disabled by setting parameter DF_FUNCTION to “None”. Reverse cycle defrosting requires a *reversing valve* on each *circuit*
(CIR_INVERSION_VALVE_DO_i_PHY, i = ith *circuit*). If a *circuit* is defrosting, its *reversing valve* is deactivated (CIR_INVERSION_VALVE_DO_i_PHY = FALSE, i = index of *defrost circuit*).
The figure below illustrates the *defrost* and drip phases and shows the behaviour of the *reversing valve*. For the *Circuit* and *Fans*, please refer to the next sections

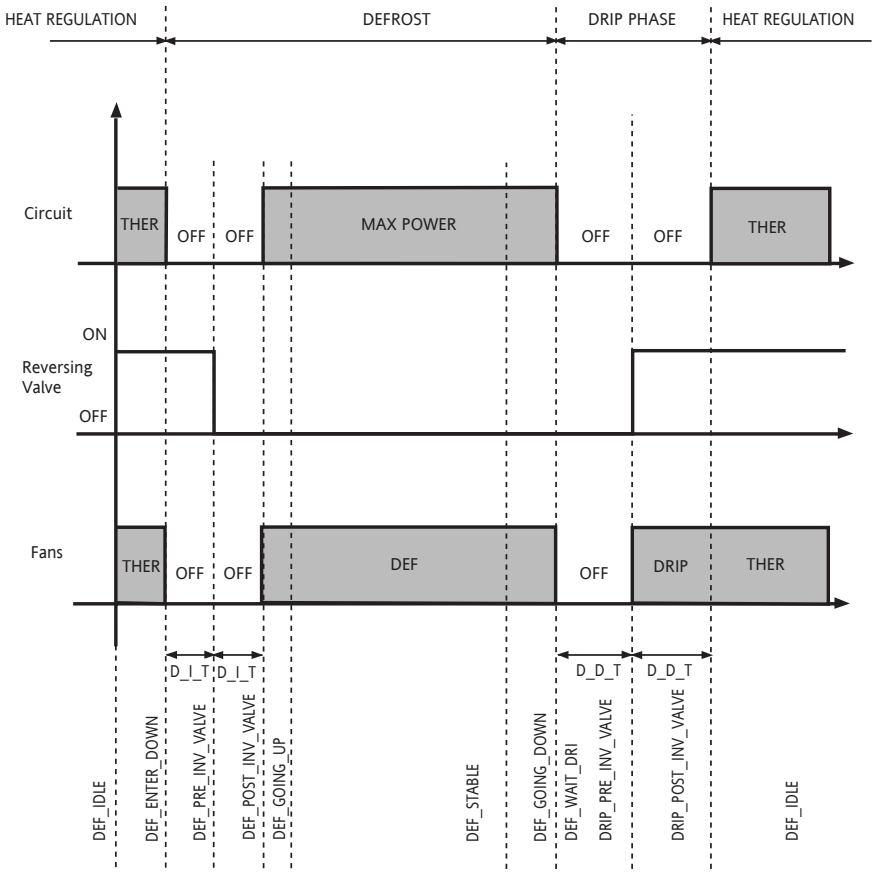


Fig.6.1

D_I_T:	DF_INVERSION_TIME
D_D_T:	DF_DRIP_TIME

6.2 Defrost starting conditions

The conditions required for *defrost* are as follows:

- When the pressure detected by the maximum pressure sensor of the ith *circuit* (CIR_PRES_MAX_SENS_i_PHY) falls below the value of parameter DF_START_PRES (*defrost* start pressure) and the *circuit* is delivering at least one power step, the *defrost* delay time is started and whose value is settable with parameter DF_START_DELAY_TIME.
- When the pressure returns above the value of parameter DF_START_PRES (*defrost* start pressure) or the *circuit* is not delivering any power steps, the *defrost* delay time count is stopped.
- The *defrost* delay time count DF_START_DELAY_TIME is also reset after a *defrost* cycle, after a Power Down, after a operating mode change, and after a switch on or switch *off* from keypad.
- The *defrost* delay time count DF_START_DELAY_TIME is reset if the pressure rises above the value of parameter DF_STOP_PRES (*defrost* stop pressure).
- When the delay time count is over, if the pressure detected by the *defrost* sensor is still below the value set by parameter DF_START_PRES (*defrost* start pressure) and the other conditions for starting *defrost* are still present (*circuit* delivering at least one power step), the circuits start to go *off*, after which *defrost* starts for the maximum time set by parameter DF_MAX_DURATION_TIME and minimum by parameter DF_MIN_DURATION_TIME.

When *defrost* starts, the *compressor* safety times are reset with the values set for the *defrost* (DF_INTER_STEP_TIME). The number of *compressor* starts per hour is zeroed and reset, thus counting the starts during *defrost*. The *compressor* safety times (minimum ON time and minimum *OFF* time) are then "inhibited" until the *defrost* stop conditions are detected. This is to make *defrost* as rapid as possible.

- The time between the last *defrost* in the *circuit* and the start of the next *defrost* must be at least equal to DF_MIN_REST_TIME.
- The delay time count between defrosts DF_MIN_REST_TIME is "reset" after a Power Down, after an operating mode change, and after a switch on or switch *off* from keypad.

If there are several circuits belonging to the same fan battery and one of them goes into *defrost*, all the other circuits are forced to *defrost* without taking into account time DF_START_DELAY_TIME (simultaneous *defrost*)

6.3 Control during defrost

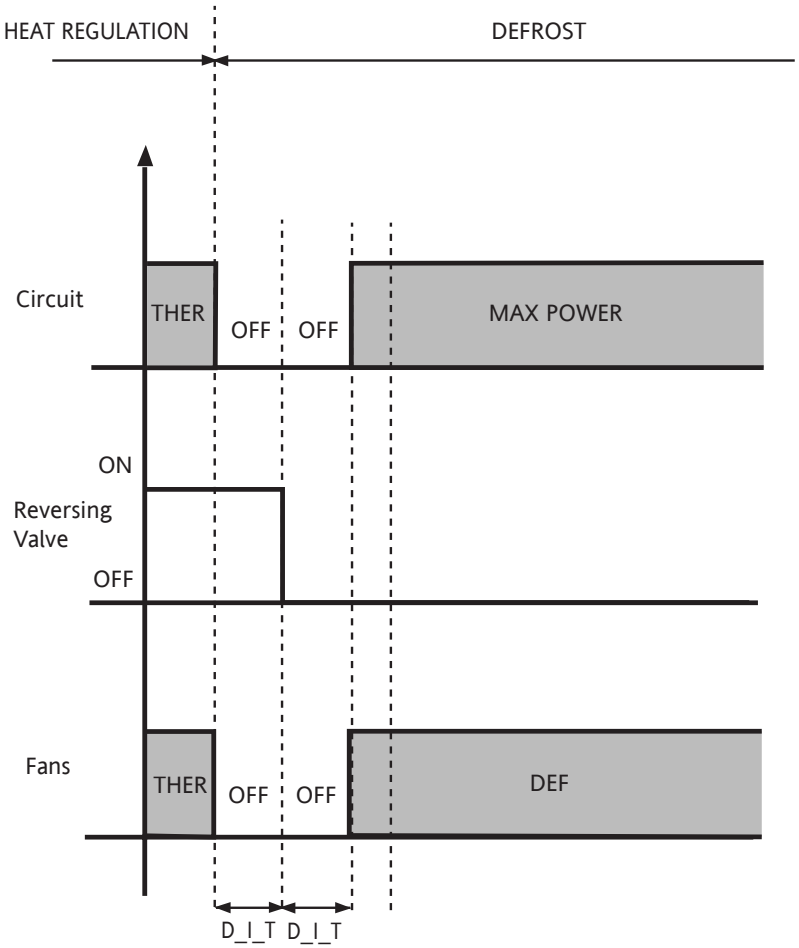


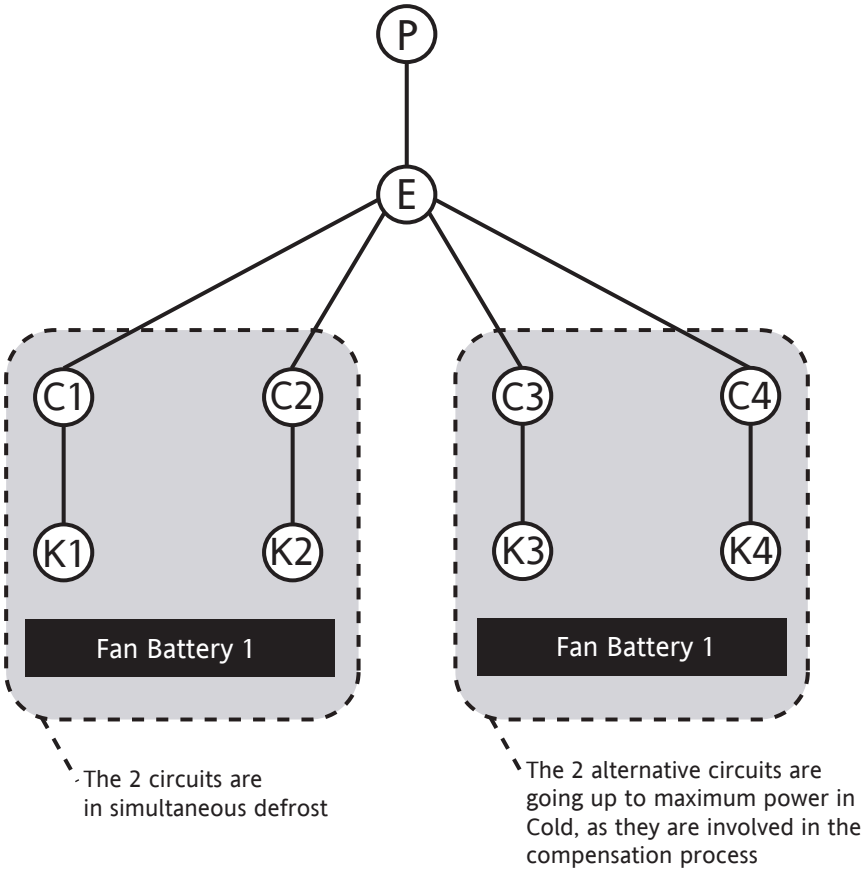
Fig. 6.3

D_I_T:	DF_INVERSION_TIME

6.3.1 Circuit

At the start of *defrost*, if time DF_INVERSION_TIME is different from zero, the regulation shown in Figure 6.3 is carried out: at the start of *defrost*, the *circuit* is switched *off* (DEF_IDLE→ DEF_ENTER_DOWN). When *off* (its compressors *off*), a delay time equal to DF_INVERSION_TIME (DEF_ENTER_DOWN → DEF_PRE_INV_VALVE) is counted, after which the *circuit reversing valve* is reversed (CIR_INVERSION_VALVE_DO_i_PHY, i = index of *circuit*). Another delay time is then counted, for time DF_INVERSION_TIME (DEF_PRE_INV_VALVE→ DEF_POST_INV_VALVE), after which the *circuit* restarts (DEF_PRE_INV_VALVE→ DEF_GOING_UP).
If DF_INVERSION_TIME = 0, any *compressor*(s) on in the *circuit* to be defrosted will remain on (DEF_IDLE → DEF_GOING_UP).
In *defrost*, the compressors in the *circuit* being defrosted are activated at full power until reaching their maximum (DEF_GOING_UP→ DEF_STABLE). The time equal to DF_INTER_STEP_TIME is respected between the *compressor* power steps (MAX POWER zone of *Circuit* in the Figure).
Note that if at least one *circuit* has not yet reached full power in *defrost*, the occurrence of *defrost* stop conditions for any *circuit* will involve the termination of *defrost*, with switching *off* of the circuits with the times between *defrost* steps (DF_INTER_STEP_TIME) and the following drip phase.
Obviously, the compressors in circuits not involved in *defrost* are, or remain, activated by the temperature controller according to the standard temperature *control* policies. Unless there is a request for compensation through the parameter DF_MAX_POWER_FLAG which activates the compressors at full power in the alternative circuits to those defrosting.

The alternative circuits are those belonging to the same *evaporator* block to which the *defrost circuit* belongs, but which are not connected to the fan battery involved in the defrosting.
Given below is an example of a 1-4-4 reversible machine with parameter DF_MAX_POWER_FLAG set to YES *:*



6.3.2 Reversing valve

At the start of *defrost*, the *reversing valve* is actuated as described in the section Compressors.
A *circuit* minimum pressure bypass time, equal to parameter DF_BYPASS_MIN_TIME, is counted from the moment the valve is reversed.
Note that whenever the position of the *circuit reversing valve* is changed, the minimum pressure alarm bypass is regulated by the higher between A_MIN_PRES_BYPASS_TIME and DF_BYPASS_MIN_TIME.

6.3.3 Fans

At the start of *defrost*, if time DF_INVERSIONE_TIME is different from zero, the *fans* are forced *off* for twice the duration (fan *OFF* zones in Figure 4.2). After this time has elapsed, if the pressure detected (equal to the highest of the values CIR_PRES_MAX_SENS_i_PHY detected by the sensors, where "i" is the index of circuits involved in the *defrost*) exceeds the 'start *fans* in *defrost*' threshold DF_MAX_FANSP_PRES, the *fans* are activated at full power. If the pressure falls below (DF_MAX_FANSP_PRES-DF_MAX_FANSP_DELTA_PRES) the *fans* are stopped (*fans* DEF zone shown in Figure 4.2). If DF_INVERSIONE_TIME = 0, the *fans* do not go through the forced *off* status and are controlled directly as in *defrost*.
.

6.4 Conditions for exiting defrost

Exiting *defrost* occurs *:*

- When the *defrost* in progress reaches the maximum time which is equal to DF_MAX_DURATION_TIME (maximum *defrost* time).
- If the *defrost* pressure exceeds DF_STOP_PRES (*defrost* pressure) and time DF_MIN_DURATION_TIME has elapsed (minimum *defrost* time).

The above conditions are evaluated when the defrosting power is increasing (DEF_GOING_UP) or steady at maximum (DEF_STABLE). The minimum safety times that the compressors remain ON and *OFF* are applied again: the ON time at the next start and the *OFF* time for each *compressor* exiting *defrost*

6.5 Control while exiting defrost and during drip time

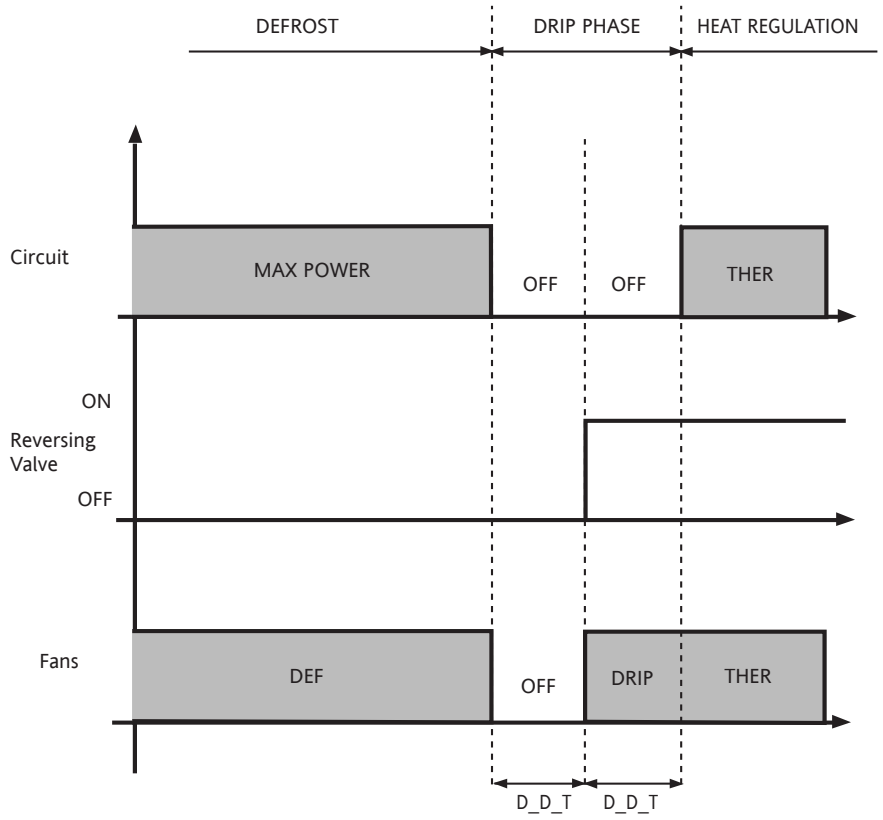


Fig.6.5

D_D_T:	DF_DRIP_TIME

6.5.1 Circuit

At the end of *defrost*, if time DF_DRIP_TIME <> 0, temperature *control* is carried out as shown in the figure.
The steps of compressors in the *circuit* exiting *defrost* are switched *off*, respecting the time DF_INTER_STEP_TIME (DEF_STABLE→ DEF_GOING_DOWN). When the *circuit* is *off*, a delay time equal to DF_DRIP_TIME (DEF_GOING_DOWN→ DRIP_PRE_INV_VALVE) is counted, after which the *circuit reversing valve* is reversed (CIR_INVERSION_VALVE_DO_i_PHY, i = index of the *circuit*). Another delay time equal to DF_DRIP_TIME (DRIP_PRE_INV_VALVE→ DRIP_POST_INV_VALVE) is then counted, after which the *circuit* is again under *control* of the temperature controller (*circuit* THER zone in Figure 6.5 DRIP_POST_INV_VALVE→ DEF_IDLE).
The timer DF_MIN_REST_TIME is then started.
If DF_DRIP_TIME = 0, any compressors On in the *circuit* being defrosted come immediately under the *control* of the temperature controller (DEF_STABLE→ DEF_IDLE). In case of simultaneous *defrost* and for DF_DRIP_TIME<>0, even if a *circuit* has completed *defrost* (DEF_GOING_DOWN→ DEF_WAIT_DRIP) with *compressor*/s *off*, these remain *off* until the last *circuit* has finished defrosting (DEF_WAIT_DRIP→ DRIP_PRE_INV_VALVE). The drip phase then begins. The circuits in which the compensation function was active come back under *control* of the *heating mode* temperature controller after the drip time has ended. However, if DF_DRIP_TIME=0, all circuits come back under *control* of the temperature controller only when the last *circuit* goes *off*.

6.5.2 Reversing valve

At the end of *defrost*, the *reversing valve* is reversed as described in the section Compressors.
A *circuit* minimum pressure bypass time, equal to parameter DF_BYPASS_MIN_TIME, is counted from the moment the valve is reversed.
Note that whenever the position of the *circuit reversing valve* is changed, the minimum alarm bypass is regulated by the parameter A_MIN_PRES_BYPASS_TIME.

6.5.3 Fans

During dripping, the *fans* are switched *off* before the *reversing valve* is reversed. From the time the valve is reversed and for time DF_DRIP_TIME, the *fans* are controlled according to parameter DF_DRIP_*FANS*_MAXPOWER_FLAG (*Fans* DRIP zone in the Figure).
If DF_DRIP_*FANS*_MAXPOWER_FLAG=NO, the *fans* are forced *off*.
If DF_DRIP_*FANS*_MAXPOWER_FLAG=YES, the *fans* are forced at full power.
At the end of time DF_DRIP_TIME, the *fans* are controlled by the fan regulator in *heating mode* (*Fans* THER zone in the Figure)

6.6 ON/OFF management during defrost

If the system is switched *off* after activating the *defrost* start procedure but before the circuits involved in the *defrost* go from *off* to on to reach maximum power (DEF_ENTER_DOWN, DEF_PRE_INV_VALVE, DEF_POST_INV_VALVE), the system immediately exits *defrost* and also skips dripping (DEF_IDLE). The circuits are then immediately ready to prepare for another *defrost*, since the time between successive defrosts is not started.

If the system is switched *off* while the circuits are going to full power in *defrost* (DEF_GOING_UP) or are already delivering it (DEF_STABLE), they are switched *off* (DEF_GOING_UP→ DEF_GOING_DOWN) and go into the drip phase.
If the system does not go through the *off* phase, the time between successive defrosts is respected, otherwise, at the next machine start, the circuits are immediately ready to prepare for another *defrost*.

In particular, in the following situations:

- system change from on to *off*;
- at the next Power On;
- when exiting configuration mode;

the delay time between defrosts (DF_MIN_REST_TIME) is reset, to allow a possible immediate *defrost*, and the *defrost* start delay time (DF_START_DELAY_TIME) is reset

Modbus address (hex)	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of transcoding	UM
420	DF_FUNCTION	Enable *defrost:* NONE=not enabled ECH400=enabled in ECH400 mode	4...5	4	23	C	V	4=standard 5=NONE	num
421	DF_MAX_POWER_FLAG	Enable maximum power request for circuits not in *defrost*.	0...1	0	6	C	V	0=NO 1=YES	flag
422	DF_DRIP_*FANS*_MAXPOWER_FLAG	Enable ventilation at maximum power during dripping	0...1	0	6	C	V	0=NO 1=YES	flag
423	DF_MIN_REST_TIME	Minimum time between successive defrosts	0...1000	240	0	C	V		min
424	DF_DRIP_TIME	Drip time	0...1000	20	0	C	V		sec
425	DF_INTER_STEP_TIME	Time between *compressor* steps during Energy 400 *defrost*	0...1000	30	0	C	V		sec
426	DF_INVERSION_TIME	Time between: - switching *off circuit* for defrosting and reversing of the *reversing valve* - reversing of the *reversing valve* and start of *circuit* in *Defrost*.	0...1000	30	0	C	V		sec
427	DF_START_PRES	Pressure value at which *defrost* is activated if the pressure remains below this value for time DF_START_DELAY_TIME	0.0...50.0	3.0	0	C	V		bar
428	DF_START_DELAY_TIME	*Defrost* start waiting time when the pressure remains below value DF_START_PRES	0...60	30	0	C	V		min
429	DF_STOP_PRES	*Defrost* exit pressure value	0.0...5.0	12.0	0	C	V		bar
42A	DF_MIN_DURATION_TIME	*Defrost* minimum duration time	0...30	5	0	C	V		min
42B	DF_MAX_DURATION_TIME	*Defrost* maximum duration time	0...60	30	0	C	V		min
42C	DF_BYPASS_MIN_TIME	*Defrost* start minimum pressure alarm bypass time	0...30	5	0	C	V		min
42D	DF_MAX_FANSP_PRES	Pressure value beyond which the *fans* go to maximum power in *defrost*	0.0...50.0	10.0	0	C	V		bar
42E	DF_MAX_FANSP_DELTA_PRES	Hysteresis delta relevant to parameter DF_MAX_FANSP_PRES	0.0...10.0	2.0	0	C	V		bar

7 DIAGNOSTICS

If enabled, all the sensor errors and alarms are usually managed with the machine on or going *off*. When system status changes from going *off* to *off*, the sensor errors and alarms are reset after exiting configuration mode or at power on.

If a sensor is not used by any of the *functions*, it can never generate a sensor error alarm, even if there is a sensor error.
For example, if there is an error in the *dynamic setpoint* current sensor and the DTSET_FUNCTION parameter <> CURRENT_FUNCTION, the corresponding alarm will never be generated.

However, if the sensor with the error is used for managing an alarm, this alarm will be reset and only the sensor error alarm will be displayed.

The following are exceptions to the nominal management:

- *antifreeze alarm*s and those for the *pump* group (flow switch and *pump* thermal protection); refer to the relevant chapters.
- BIOS alarms, which are always managed (when the system is *off*, the *cumulative alarm relay* is not activated if the BIOS alarm is active. The *red LED* on the keypad lights up and the message "!Hw" appears")

7.1 Alarm and error types

Alarms can be automatic, manual, or bounded (by time or by events); sensor errors are the automatic type.

- Automatic: the alarm is active if the cause of the alarm is present, and not active otherwise;
- Manual: the alarm is active while the cause of the alarm is present, otherwise it can be reset manually;
- Event bounded: the alarm behaves like an automatic alarm as long as the number of events in the unit of time is less than the number fixed by parameter, otherwise it behaves like a manual alarm;
- Time bounded: the alarm behaves like an automatic alarm as long as the activation status is less than the time fixed by parameter, otherwise it behaves like a manual alarm;

7.2 Signalling in case of alarm or error

7.2.1 Red LED

Sensor errors and/or alarms are signalled by the *red LED* on the keypad, and also by a menu (if present). The LED comes on if at least one alarm is active, flashes if only resettable alarms are present, and remains *off* in other cases. LED status is independent of system status (it *functions* even with the system *off*).

7.2.2 Cumulative alarm relay

The presence of sensor errors and/or resettable or active alarms is signalled by activation of the *cumulative alarm relay* (PLAN_CUMALARM_DO_PHY). The relay *functions* even when the system is in *Off* mode (obviously, for alarms that are active when the system is *off*).

7.3 Temperature control alarms

7.3.1 High temperature alarm

If the temperature value measured by the primary *circuit* inlet water sensor (PLAN_TEMP_INWATER_SENS) remains just above the temperature set by the parameter A_HIGHT_THRESHOLD_TEMP_HOT for at least the time set by by the parameter A_HIGHT_BYPASS_TIME_HOT and the machine has been set to *cooling mode*, the *high temperature alarm* is generated. This is a system blocking alarm. It is a manual reset alarm.

If one of the following conditions occurs :

- Function disabled (A_HIGHT_ENABLE_FLAG=false);
- primary *circuit water inlet sensor error*;
- System *off*;

the alarm remains *off*.

The alarm is reset:

- Manually if resettable
- System switching On or *Off*;
- Exit from configuration mode;
- By a reset;

7.3.2 Low temperature alarm

If the temperature value measured by the primary *circuit* water inlet sensor (PLAN_TEMP_INWATER_SENS) remains just below the temperature set with parameter A_LOWT_THRESHOLD_TEMP_HOT for at least the time set with parameter A_LOWT_BYPASS_TIME_HOT and the machine has been set to Cold mode, the *low temperature alarm* is generated. This is a system blocking alarm.
It is a manual reset alarm.

If one of the following conditions occurs :

- Function disabled (A_LOWT_ENABLE_FLAG=false);
- primary *circuit water inlet sensor error* ;
- System *off*;

the alarm remains *Off*.

The alarm is reset:

- Manually if resettable
- System switching On or *Off*;
- Exit from configuration mode;
- By reset

7.3.3 Water inlet sensor error

If temperature *control* occurs through the inlet water temperature sensor (TREG_TEMP_SENS = ENTRY_SENS) or if the *high temperature alarm* management is enabled (A_HIGHT_ENABLE_FLAG), an error condition in this sensor causes system "block". In the other cases, error management is not enabled for the inlet water sensor.

7.3.4 Outlet water sensor error

If temperature *control* occurs through the outlet water temperature sensor (TREG_TEMP_SENS = EXIT_SENS), an error condition in this sensor causes system "block". If temperature *control* occurs through the inlet water temperature sensor, *error management* is not enabled for the outlet water sensor.

7.3.5 Dynamic setpoint current sensor error

If *dynamic setpoint* management is enabled (DTSET_FUNCTION = DTSET_CURR), an error condition in this sensor does not block the system. If the *dynamic setpoint* is not enabled, *error management* is not enabled for the outlet water sensor.

7.3.6 Parameters involved

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of transcoding	Parameter description
245	A_HIGHT_BYPASS_TIME_HOT	1...99	15	V	0	min	H		*High temperature alarm* bypass time
248	A_LOWT_BYPASS_TIME_HOT	1...99	15	V	0	min	H		System *low temperature alarm* bypass time
243	A_HIGHT_ENABLE_FLAG	0...1	1	V	6	flag	C	0=NO, 1=YES	Enable system *high temperature alarm* (the alarm monitors the primary *circuit* inlet water temperature)
244	A_HIGHT_THRESHOLD_TEMP_HOT	-15.0...50.0	18.0	V	0	°C	H		System *high temperature alarm* setpoint
246	A_LOWT_ENABLE_FLAG	0...1	1	V	6	flag	C	0=NO, 1=YES	Enable *system low temperature alarm* (the alarm monitors the primary *circuit* inlet water temperature)
247	A_LOWT_THRESHOLD_TEMP_HOT	-15.0...50.0	30.0	V	0	°C	H		System *low temperature alarm* setpoint

7.4 Circuit management alarms

7.4.1 Circuit maximum pressure sensor error and alarm

The *circuit* maximum pressure alarm monitors the maximum pressure digital input CIR_PRES_MAX_DI_i_PHY and maximum pressure sensor CIR_PRES_MAX_SENS_i_PHY, i=ith *circuit*.

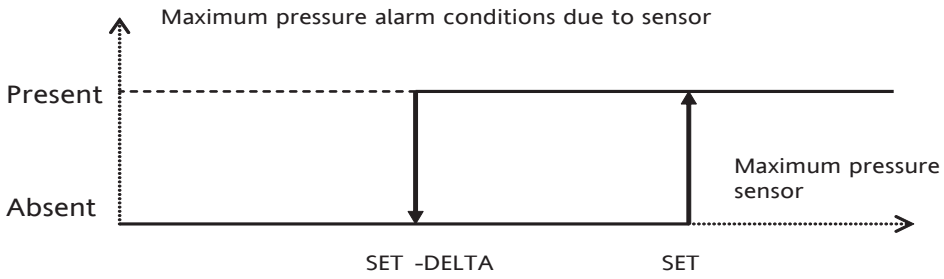


Fig 7.4.1

SET	A_MAX_PRES
DELTA	A_MAX_DELTA_PRES
Maximum pressure	CIR_PRES_MAX_SENS_i_PHY, i = ith *circuit*

When the system is *Off* the alarm remains *off*.
When the system is switched on in *cooling mode* or when going *off*, the alarm is controlled by the hysteresis function shown in Fig 7.4.1, in OR logic with digital input status CIR_PRES_MAX_DI_i_PHY .
For the hysteresis function in particular, an alarm condition is Present if sensor >=SET, Absent if sensor <(SET-DELTA), and unchanged in the other cases.

The resulting alarm condition is used to generate an alarm, reset manually, which blocks the *circuit* concerned.

The hysteresis function is set to Absent in the following cases:

- System Switching On or *Off*;
- Exit from configuration mode;
- By reset;
- Maximum pressure sensor error;

If there is an error in the *circuit* maximum pressure sensor, the *circuit* concerned is blocked. If the maximum pressure switch is not activated, only the sensor error is displayed, otherwise the maximum pressure alarm is displayed. In the latter case, if the pressure switch is reset, the maximum pressure alarm is reset automatically. In any case the *circuit* is blocked by the sensor error.

7.4.2 Circuit minimum pressure alarm

Control of minimum pressure alarm condition is always enabled if:

- Machine on or going *off*
- pumpdown is not enabled;
- pumpdown is enabled and the FINISH_PDA or FINISH_PDS phases are active with the solenoid valve open;

This algorithm activates the minimum pressure alarm by monitoring the minimum pressure digital input CIR_PRES_MIN_DI_i_PHY, where i= ith *circuit*.

The alarm is bypassed for time A_MIN_PRES_BYPASS_TIME, which is loaded with every change in *circuit* power input not due to the alarm itself. Also refer to the section on *Defrosting*.

The alarm is automatic reset. If the number of alarm activations in one hour exceeds the value of parameter MAX_MINP_ALARMS_NO, the alarm becomes manual reset. Starts are stored with a time resolution of 3600/32 seconds.

When an alarm occurs, the *circuit* is switched *off*.

Alarm management is always reinitialised and the alarm is reset:

- if the alarm is reset manually
- when system status changes from *Off* to cooling
- when exiting configuration mode.
- at Power On

7.4.3 Parameters involved

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of transcoding	Parameter description
2E0	A_MAX_PRES	0.0...50.0	28.0	V	0	Bar	C		*Circuit* maximum pressure alarm setpoint
2E1	A_MAX_DELTA_PRES	0.0...10.0	2.0	V	0	Bar	C		*Circuit* maximum pressure alarm Delta
2E2	MAX_MINP_ALARMS_NO_HOT	0...20	3	V	0	Num	H		Maximum number of minimum pressure alarms in the hour before the alarm changes from automatic to manual
2E3	A_MIN_PRES_BYPASS_TIME_HOT	0...500	120	V	0	Sec	H		Minimum pressure alarm bypass time

7.5 Fan thermal protection alarm

A single *fan* thermal protection input is provided for fan battery, regardless of the number of *fans* in the battery. Activation of the fan battery thermal protection always causes immediate blocking of the battery and all compressors belonging to its circuits. It is a manual reset alarm.

7.6 Hydraulic pump management alarms

7.6.1 Flow switch alarm

Management of this alarm is active if the machine is started in *cooling mode* or going *off*, or if the heaters are on (*antifreeze* or frost prevention).

The controller responds to the *flow switch alarm* signals after some delays. For example, the *flow switch alarm* must be present for a certain period of time before becoming “effective”, i.e. before it is processed and managed by the controller. In the following we distinguish between “*flow switch alarm*” (the flow switch is sending the controller an alarm signal, but the controller is not yet in a “*flow switch alarm*” phase) and “logic alarm” (the controller has gone into a *flow switch alarm* management phase).

A_FS_BYPASS_STARTUP_TIME defines the time interval, when the pumps are started, during which *flow switch alarms* are ignored.

Parameter **A_FS_ENTRY_TIME** defines the time interval, during normal operation of the pumps (after time **A_FS_BYPASS_STARTUP_TIME** has elapsed), during which the occurrence or persistence of a *flow switch alarm* is ignored. The alarm will become effective and automatic if it continues after the end of such time interval.

Parameter **A_FS_EXIT_TIME** defines the time interval (after a flow switch logic alarm has occurred) during which the *flow switch alarm* must not persist continuously before the logic alarm condition is deemed reset.

A_FS_AUTOMATIC2MANUAL_TIME defines the time a logic alarm must continue before its management changes from automatic to manual.

7.6.2 Pump thermal protection alarm

Management of this alarm is active if the machine is started or going *off*, or if the heaters are on (*antifreeze* or frost prevention).
The *pump thermal protection alarm* is with manual reset, and blocks the *pump* currently in use.

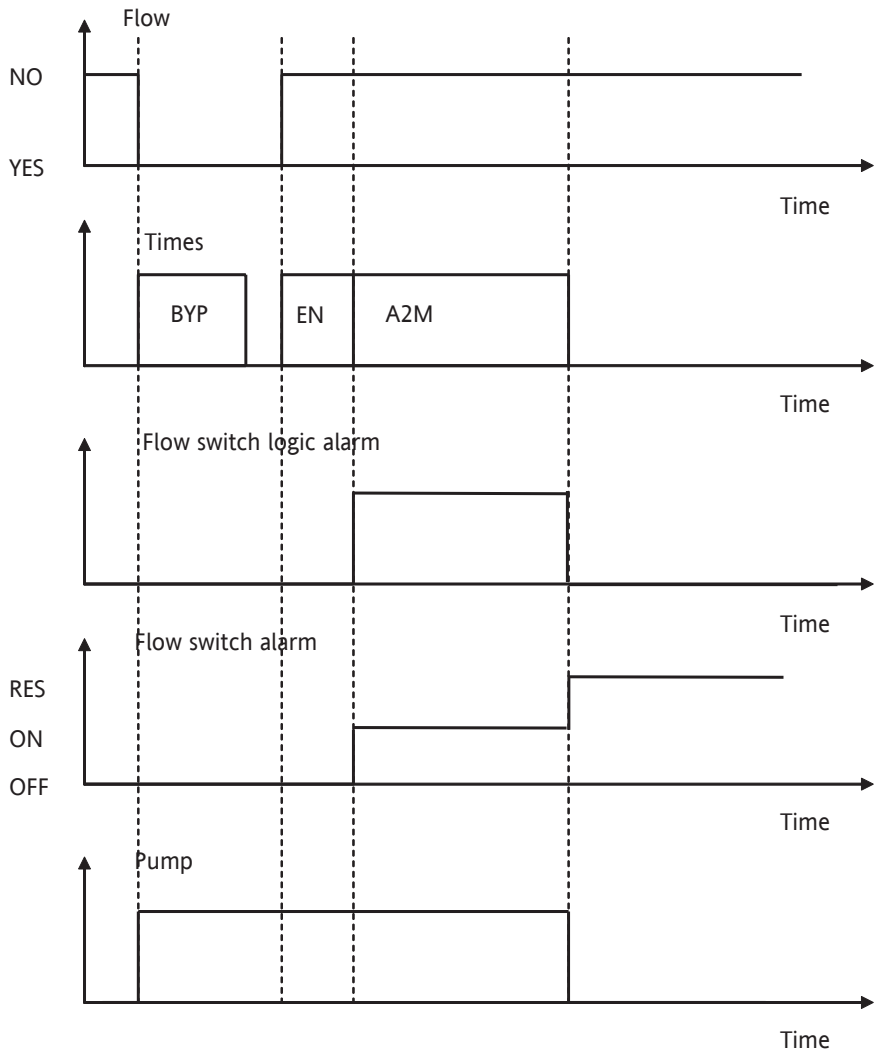
7.6.3 Pump management in case of a pump thermal protection or flow switch alarm

In case of a flow switch logic alarm or *pump* thermal protection activation, the system behaves differently depending on whether one or two pumps are present.

7.6.3.1 PUMPS_NO=1

If the *pump* thermal protection is activated, the system is immediately blocked and thermal protection manual alarm is activated. When the *pump* thermal protection is deactivated, the alarm must be reset so that the *pump* can become available again and allow the system to restart.

Flow switch alarm **always active**

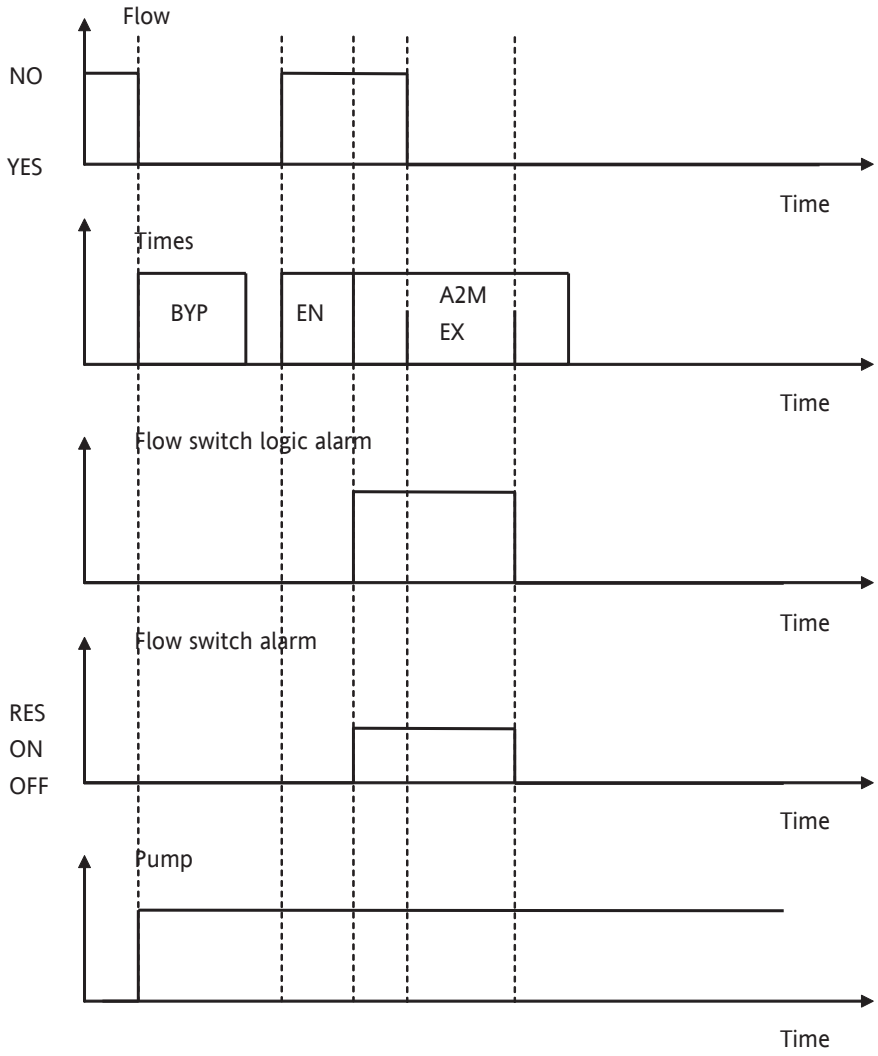


Flow	*PUMP*_A_FLOW_DI_PHY
Pump	*PUMP*_ACC_DO_1_PHY

Note that the system is also blocked as soon as the *pump* is switched *off*.

- The alarm condition is reset:
- by manually resetting the alarm;
- by changing from On to *Off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting configuration mode.

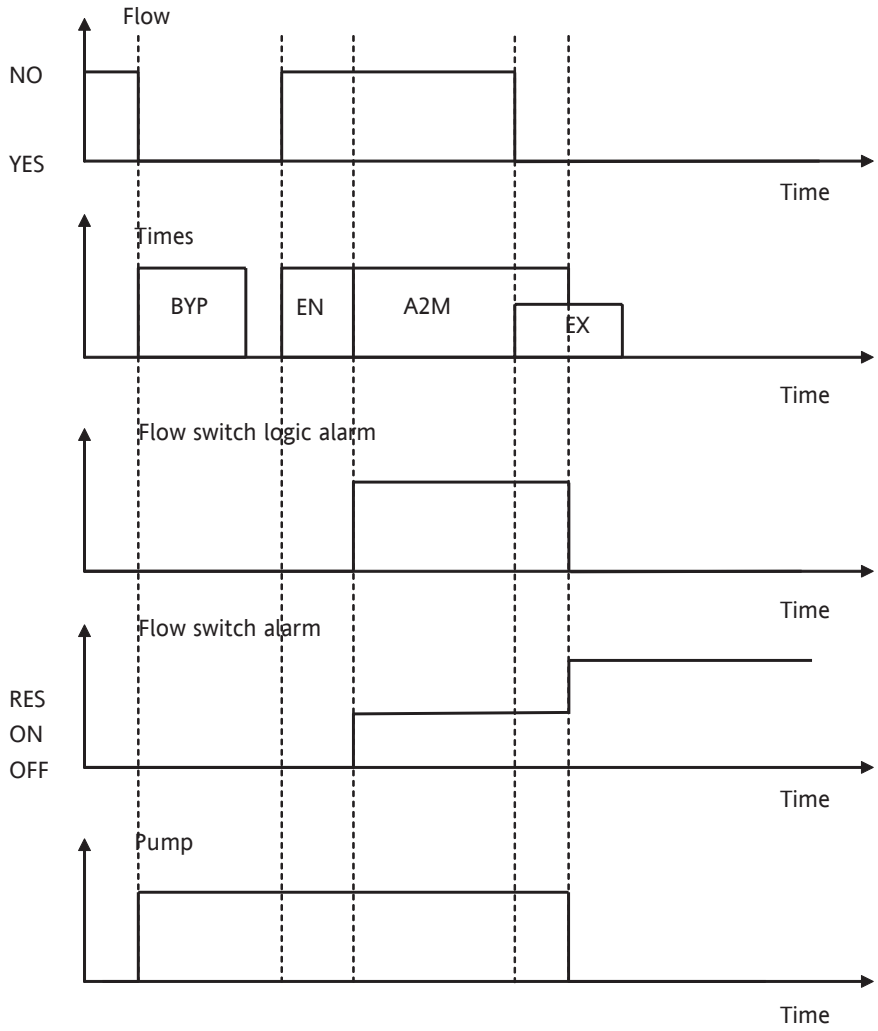
Flow switch logic alarm reset before time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



Flow	*PUMP*_A_FLOW_DI_PHY
Pump	*PUMP*_ACC_DO_1_PHY

In this case, the alarm resets automatically without causing any blocking of the system.

Flow switch logic alarm reset after time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



Flow	*PUMP*_A_FLOW_DI_PHY
Pump	*PUMP*_ACC_DO_1_PHY

Note that the system is also blocked as soon as the *pump* is switched *off*.

The alarm condition is reset *:*

- by manually resetting the *flow switch alarm*;
- by changing from On to *Off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting configuration mode;

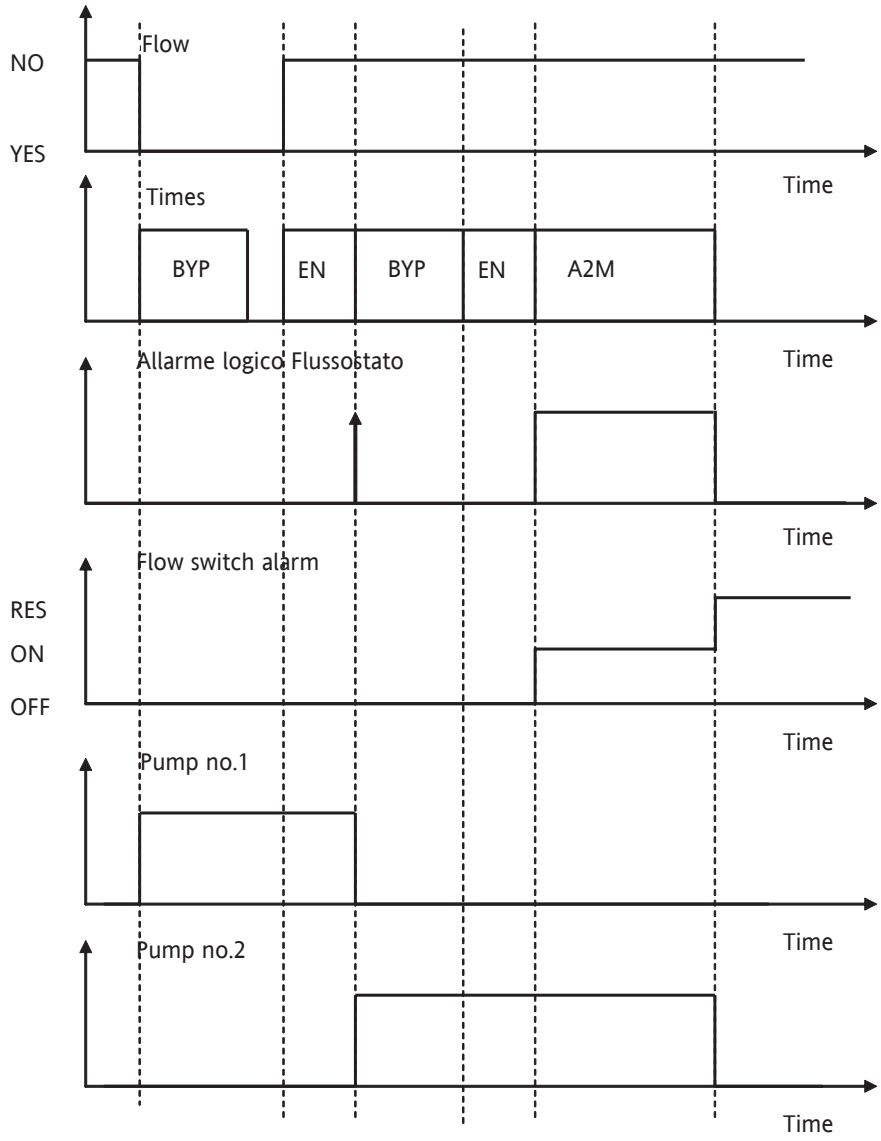
7.6.3.2 PUMPS_NO=2

If the *pump* thermal protection is activated or there is a flow switch logic alarm, and there is another *pump* available, the system tries to use the other *pump* to ensure the water flow in the primary *circuit*.
Otherwise (if no other *pump* is available), the system behaves as in the case *PUMPS_NO=1*.

7.6.4 Pump not available alarm

In case of a *pump* “alarm swap” in the *pump* group, e.g. due to the flow switch, and the second *pump* is able to ensure the flow, a "not available" alarm is established for the first *pump*. This alarm can always be reset manually.

Flow switch alarm **always active**

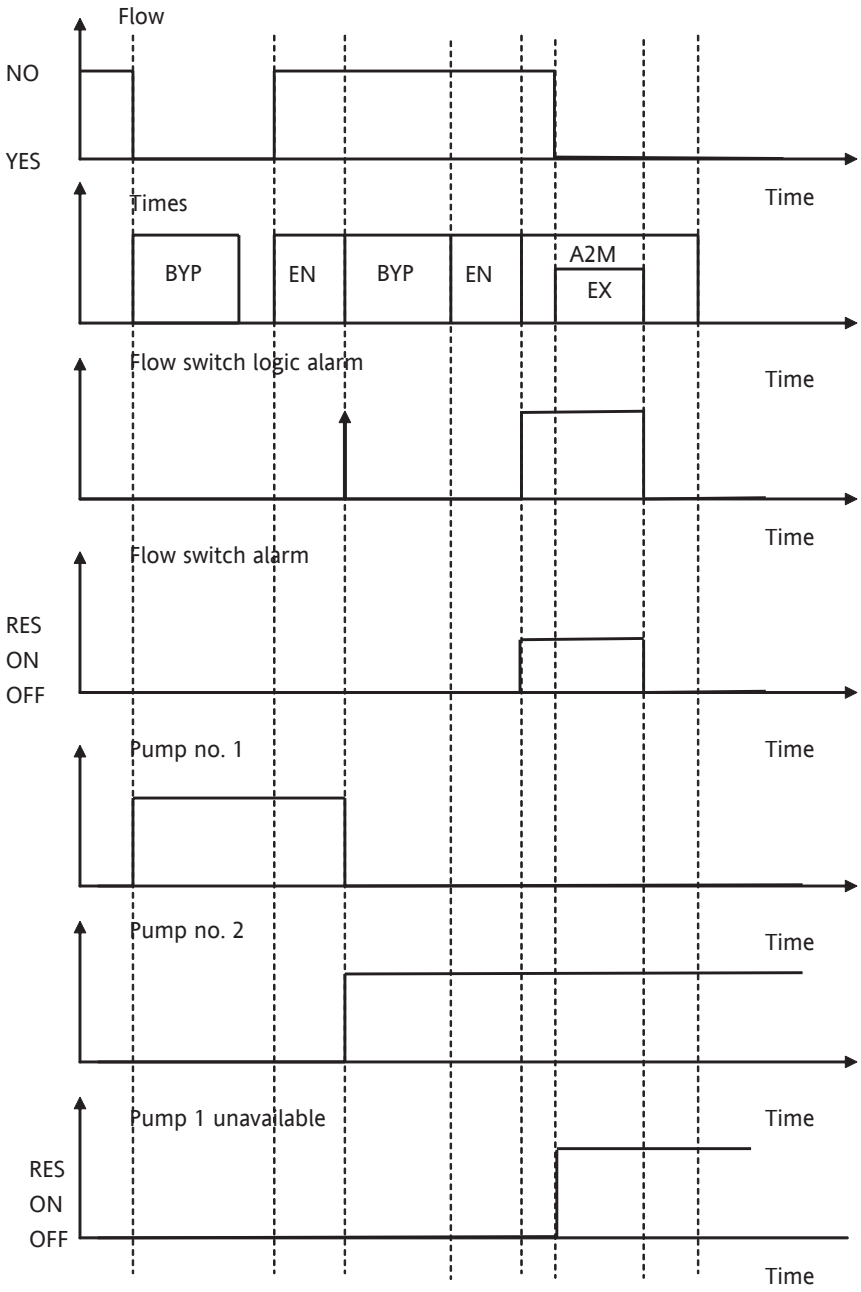


Flow	*PUMP*_A_FLOW_DI_PHY
Pump 1	*PUMP*_ACC_DO_1_PHY
Pump 2	*PUMP*_ACC_DO_2_PHY

Note that the system is also blocked as soon as *pump* 2 is switched *off*.
The alarm condition is reset*:*

- by resetting the alarm manually;
- by changing from On to *Off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting configuration mode.

Flow switch logic alarm reset before time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



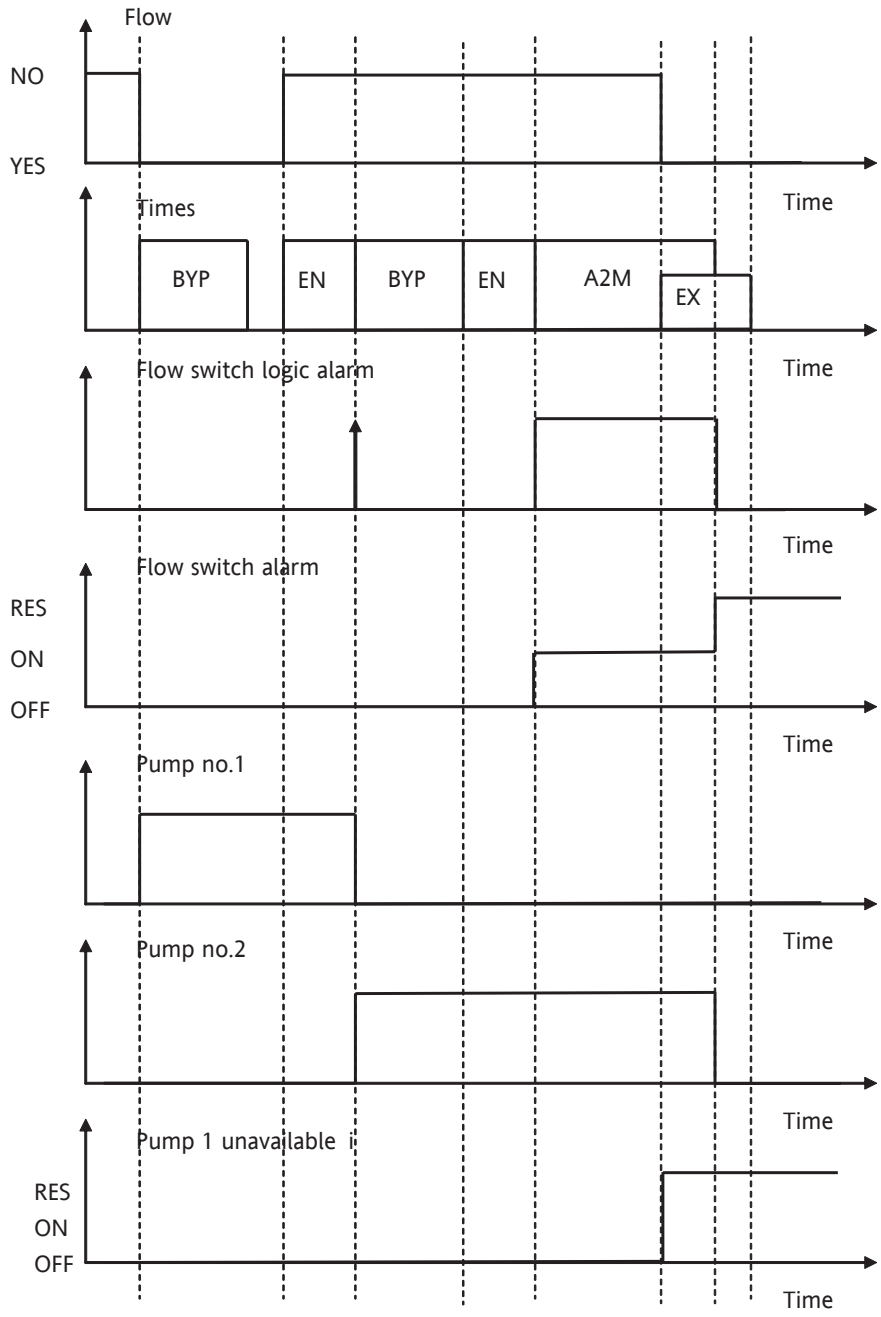
Flow	*PUMP*_A_FLOW_DI_PHY
Pump 1	*PUMP*_ACC_DO_1_PHY
Pump 2	*PUMP*_ACC_DO_2_PHY

Note that as soon as *pump* 1 is switched *off*, the system is not blocked but the second available *pump* is activated. Since the second *pump* ensures the flow, the "*Pump* 1 not available" alarm, manually resettable, is signalled and the system continues to function normally.

This alarm is reset:

- manually;
- by changing from On to *Off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting configuration mode.

Flow switch logic alarm reset after time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



Flow	*PUMP*_A_FLOW_DI_PHY
Pump 1	*PUMP*_ACC_DO_1_PHY
Pump 2	*PUMP*_ACC_DO_2_PHY

Note that as soon as *pump* 1 is switched *off*, the system is not blocked but the second available *pump* is activated.
Since the also second *pump* does not ensure the flow, the *pump* and the system are blocked (when the second *pump* goes *off*), the "*Pump* 1 not available" alarm (resettable) is signalled and the *flow switch alarm* becomes resettable

The *flow switch alarm* and "*pump* not available" alarm are reset:

- manually;
- by changing from On to *Off* (from keypad or remote ON/*OFF*);
- at the next Power On;
- when exiting configuration mode.

and the system resumes normal operation.

7.6.5 Parameters involved

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of transcoding	Parameter description
460	A_FS_BYPASS_STARTUP_TIME	1...99	30	V	0	Sec	C		*Flow switch alarm* bypass time
461	A_FS_ENTRY_TIME	0...60	10	V	0	Sec	C		The time the flow switch remains in physical alarm condition before the alarm is treated as present
462	A_FS_EXIT_TIME	0...60	10	V	0	Sec	C		The time the flow switch remains in physical non-alarm condition before the alarm is treated as not present
466	A_FS_AUTOMATIC2MANUAL_TIME	1...60	20	V	0	Sec	C		Time after which the *flow switch alarm* changes from automatic to manual (must be greater than time A_FS_EXIT_TIME)
222	PUMPS_NO	1...2	2	V	0	Num	C		Number of pumps in the system

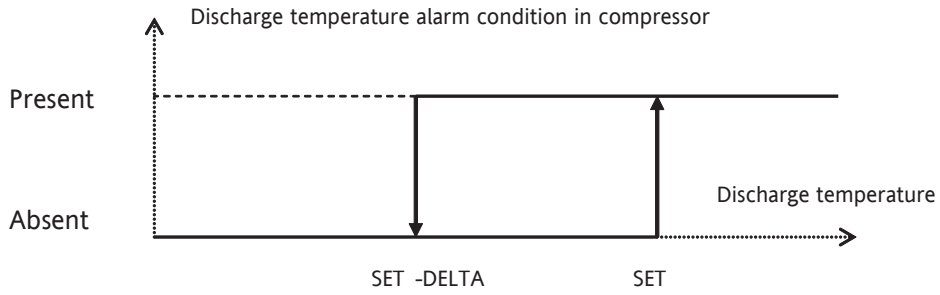
7.7 Compressor management alarms

7.7.1 Compressor thermal protection alarm

Management of this alarm is enabled by parameter A_KOMP_THER_ENABLE_FLAG and is active if the machine is switched on in *cooling mode* or going *off* and the *compressor* is selected.
The *compressor thermal alarm* is a manual reset alarm and blocks the *compressor* currently in use.

The alarm is reset:

- manually;
- by changing from On to *Off*;
- at the next Power On;
- when exiting configuration mode.



7.7.2 Compressor discharge temperature alarm

Fig 7.7.2

SET	A_DISCHARGE_TEMP
DELTA	A_DISCHARGE_DELTA_TEMP
Discharge temperature	KOMP_TEMP_DISCHARGE_SENS_i_PHY, i = ith *compressor*

If one of the following conditions occurs :

- Function disabled (A_DISCHARGE_ENABLE_FLAG =false);
- Discharge temperature sensor error;
- System *off*;
- *Compressor* deselected.

the alarm remains *Off*.

If none of the above conditions occurs, the alarm is controlled by the hysteresis function shown in Fig 7.7.2, where the alarm condition is used to generate a manual reset alarm.

The hysteresis function is set to *Off* in the following cases:

- System switching on or *off*;
- Exit from configuration mode;
- By reset;

7.7.3 Compressor discharge temperature sensor error

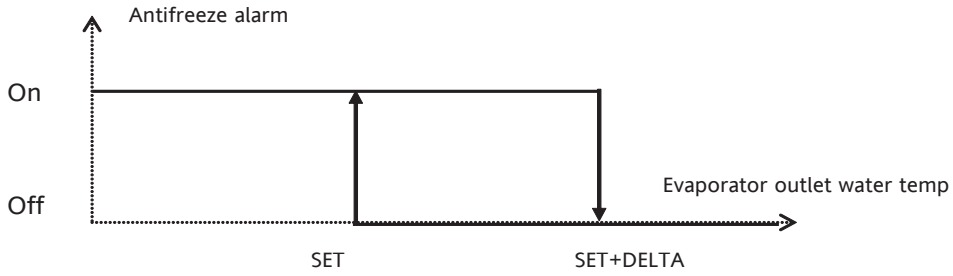
The sensor error is managed if the *compressor discharge temperature alarm* is enabled, or the liquid injection function is enabled and the *compressor* is selected.
In case of sensor error, the *compressor* associated with that sensor is blocked.

7.7.4 Parameters involved

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of transcoding	Parameter description
2F8	A_KOMP_THER_ENABLE_FLAG	0...1	1	V	6	Flag	C	0=NO; 1=YES	Enable *compressor thermal protection alarm*
2F6	A_DISCHARGE_TEMP	40.0...150.0	125.0	V	0	°C	C		*Compressor discharge temperature alarm* setpoint
2F7	A_DISCHARGE_DELTA_TEMP	0...30.0	30.0	V	0	°C	C		*Compressor discharge temperature alarm* Delta
2F5	A_DISCHARGE_ENABLE_FLAG	0...1	1	V	6	Flag	C	0=NO; 1=YES	Enable *compressor discharge temperature alarm*

7.8 Antifreeze alarm

Control of the *antifreeze alarm* condition is enabled by means of parameter AF_ENABLE_FLAG independently of machine On in *cooling mode*, going *off* or *Off* status.
The algorithm activates the *antifreeze alarm*, monitoring the outlet temperature of each *evaporator* according to the hysteresis function with setting AF_CH_SET_TEMP/AF_HEATING_SET_TEMP and delta AF_CH_DELTA_TEMP/AF_HEATING_DELTA_TEMP, as shown in the figure.



SET	AF_CH_SET_TEMP/AF_HEATING_SET_TEMP
DELTA	AF_CH_DELTA_TEMP/AF_HEATING_DELTA_TEMP
Water temperature at *Evaporator outlet*	EV_TEMP_OUTWATER_SENS_i_PHY, i = ith *evaporator*

In particular, the *antifreeze alarm* is On if water temperature < SET, *Off* if water temperature = >(SET+DELTA), unchanged in the other cases.

The alarm is bypassed for time AF_CHILLING_BYPASS_TIME/AF_HEATING_BYPASS_TIME which is loaded at Power On, at switch on in *cooling mode*, when exiting configuration mode, and after reset of an *antifreeze alarm* condition (on resetting of alarm if manual) or an alarm condition in the *evaporator* outlet water sensor.

The alarm is with automatic reset. If the number of alarm activations in one hour exceeds the value of parameter MAX_AF_ALARMS_NO the alarm becomes a manual reset alarm.
When the alarm occurs (an alarm in any of the evaporators), the system is switched *off* and the *antifreeze* heaters (in all evaporators) are switched on if parameter AF_USE_RESISTOR_FLAG=yes.

Note
Activation of the heaters causes a request for activation of one of the pumps in the *pump* group, to allow water to circulate in the *primary circuit*.

Alarm management is always reinitialised at Power On, when system status changes from *Off* to On, and when exiting configuration mode. If the system changes from On to *Off*, *antifreeze alarms* are not reset.

An error in this sensor causes system "block" (including *pump* group and *antifreeze* heaters).

7.8.1 Antifreeze sensor error

Errors in the sensor that monitors the *evaporator* outlet water temperature are managed, with the machine on or going *off*, if AFPR_COOLING_ENABLED_FLAG=yes, and also with the machine *off* if AFPR_*OFF*_STDBY_ENABLE_FLAG =yes. If AF_ENABLE_FLAG=yes (*antifreeze* enabled), an error in this sensor is always processed regardless of the system operating mode.
An error in this sensor causes system "block" (including *pump* group and *antifreeze* heaters).

7.8.2 Parameters involved

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of transcoding	Parameter description
2B0	AF_ENABLE_FLAG	0...1	1	V	6	Flag	C	0=NO; 1=YES	Enable *antifreeze function*
2B2	AF_CH_SET_TEMP	-50.0...150.0	3.0	V	0	°C	C		*Antifreeze alarm setpoint*
2B3	AF_CH_DELTA_TEMP	0.0...10.0	4.0	V	0	°C	C		*Antifreeze alarm delta*
2B4	AF_CHILLING_BYPASS_TIME	0...1000	30	V	0	Sec	C		*Antifreeze alarm bypass time*
2B6	AF_HEATING_SET_TEMP	-50.0...150	1.0	V	0	°C	C		*Antifreeze alarm* setpoint in *heating mode*
2B7	AF_HEATING_DELTA_TEMP	0.0...10.0	4.0	V	0	°C	C		*Antifreeze alarm* delta in *heating mode*
2B8	AF_HEATING_BYPASS_TiME	0...1000	30	V	0	sec	C		*Antifreeze alarm* bypass time in *heating mode*
2B5	MAX_AF_ALARMS_NO	0...1000	0	V	0	Num	C		Maximum number of *antifreeze alarms* in the hour before the *antifreeze alarm* changes from automatic to manual
2B1	AF_USE_RESISTOR_FLAG	0...1	1	V	6	Flag	C		Enable use of the heaters in case of *antifreeze alarm*

7.9 Defrost alarm management

Three situations can occur:

Situation 1:
If at least one of the following conditions is present:

- system alarm (high/low temperature, inlet/outlet water sensor and expansion timeout),
- *pump* group alarm (flow switch blocking alarm, a *pump* will not start);
- *evaporator* (*antifreeze*) alarm;
- *circuit* and/or *compressor* alarm *preventing* any *compressor of the fan* battery from starting or remaining on;
- fan battery *fan thermal protection alarm*, *defrost is always stopped and ready* to be immediately reactivated (DEF_IDLE).

Situation 2:
In case of simultaneous *defrost* , if a *circuit* is *defrosting and at maximum power output* (DEF_STABLE) and an alarm is activated, or if there is an alarm in all the compressors belonging to that *circuit*, *the circuit* in alarm is switched *off* immediately (DEF_STABLE→ DEF_GOING_UP). If the alarm is reset and *defrost* is still in progress, the *circuit* returns to maximum power (DEF_GOING_UP→ DEF_STABLE).

Situation 3
In case of simultaneous *defrost* and *defrost* is already finishing and the circuits are going from maximum power to the drip phase (DEF_GOING_DOWN), if an alarm is activated in a *circuit* or in all the compressors belonging to that *circuit*, the *circuit* goes immediately to the wait drip phase (DEF_GOING_DOWN→ DEF_WAIT_DRIP), also waiting for the last *circuit* to complete the
going *off* phase.
If it is not a simultaneous *defrost* and there is a *circuit* alarm or all the compressors belonging to that *circuit* are in alarm, the *circuit* goes immediately into drip mode (DEF_GOING_DOWN→ DRIP_PRE_INV_VALVE).

7.10 Table of Alarms

MODBUS (HEX)	Name	List of BaseLine Machine Alarms	Action	Input	System	Num.	Type
04F0	PlanHTempA	High temperature in temperature *control*	blocks the system	Ana	PLANT	1	Manual
0537	PlanLTempA	Low temperature in temperature *control*	blocks the system	Ana	PLANT	1	Manual
04F1	EvAfA	*Evaporator antifreeze*	blocks the system and starts the *pump* if heaters are enabled	Ana	EV	2	Event bounded
0513	KompDisA	*Compressor* discharge temperature	blocks the *compressor*	Ana	KOMP	8	Manual
04F3	CirHPrA	*Circuit* maximum pressure	blocks the *circuit*	Ana+Dig	CIR	8	Manual
04FB	CirLPrA	*Circuit* minimum pressure	blocks the *circuit*	Dig	CIR	8	Event bounded
050B	KompTherA	*Compressor* thermal protection	blocks the *compressor*	Dig	KOMP	8	Manual
051B	FansTherA	Fan group thermal protection	blocks the circuits	Dig	FANGROUP	2	Manual
051D	FlowA	Primary flow switch	blocks the system	Dig	PUMPGROUP	1	Time bounded
051E	PumpTherA	*Pump* thermal protection	blocks the *pump*	Dig	*PUMP*	2	Manual
0520	PumpUnavailableA	*Pump* not available	makes the *pump* unavailable	Log	*PUMP*	2	Manual
0503	CirPdA	*Pump-down timeout*	non-blocking	Time	CIR	8	Automatic
0139	VAR_BOO_BIOS_1	Internal expansion timeout	blocks the system	Time	PLANT	1	Automatic
013A	VAR_BOO_BIOS_2	External expansion 1 timeout	blocks the system	Time	PLANT	1	Automatic
013B	VAR_BOO_BIOS_3	External expansion 2 timeout	blocks the system	Time	PLANT	1	Automatic
013C	VAR_BOO_BIOS_4	External expansion 3 timeout	blocks the system	Time	PLANT	1	Automatic
013D	VAR_BOO_BIOS_5	External expansion 4 timeout	blocks the system	Time	PLANT	1	Automatic

NB: In case of alarms relevant to data structures of several elements (Num. different from 1) the MODBUS address is the MODBUS address of the first element of the structure, and the subsequent elements will have increasing contiguous addresses. In case of FansTherA starting with MODBUS address 0x051B, the second will have address 0x051C.

7.11 Errors Table

MODBUS (HEX)	Name	List of sensor errors in BaseLine machine	Input	System	Num.	Action	Reset
0x0522	PlanTempInWaterSensErr	Inlet temperature *control* sensor error	Ana	PLANT	1	blocks the system	Automatic
0x0523	PlanTempOutWaterSensErr	Outlet temperature *control* sensor error	Ana	PLANT	1	blocks the system	Automatic
0x0525	EvTempOutWaterSensErr	*Antifreeze sensor error*	Ana	EV	2	blocks the system	Automatic
0x0527	CirPresMaxSensErr	*Circuit* maximum sensor error	Ana	CIR	8	blocks the *circuit*	Automatic
0x052F	KompTempDischargeSensErr	*Compressor* discharge sensor error	Ana	KOMP	8	blocks the *compressor*	Automatic
0x0524	PlanCurrDtsetSensErr	*Dynamic setpoint* sensor error	Ana	PLANT	1	inhibits dynamic regulation	Automatic
0x0538	BbxOpenError	Blackbox file opening error			1	none	Automatic
0x0539	BbxWriteError	Blackbox file write error			1	none	Automatic
0x053A	BbxCloseError	Blackbox file closing error			1	none	Automatic
0x053B	CirTempCondSensErr	Condenser temperature sensor error	Ana	CIR	8	blocks the *circuit*	Automatic

8 PARAMETERS

Parameters table

Note that COLD type *parameters* (indicated with a C in the C/H column) can only be changed in configuration mode. To enable going into configuration mode, the machine must be in *Off* mode.

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
	Structural								
200	KOMP_CIR_EV_1	Association of *compressor* 1 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	11...24	11	0	C	V		num
201	KOMP_CIR_EV_2	Association of *compressor* 2 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	12	0	C	V		num
202	KOMP_CIR_EV_3	Association of *compressor* 3 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	21	0	C	V		num
203	KOMP_CIR_EV_4	Association of *compressor* 4 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	22	0	C	V		num
204	KOMP_CIR_EV_5	Association of *compressor* 5 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
205	KOMP_CIR_EV_6	Association of *compressor* 6 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
206	KOMP_CIR_EV_7	Association of *compressor* 7 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
207	KOMP_CIR_EV_8	Association of *compressor* 8 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
208	CIR_*FANS*_1	Association of *circuit* 1 with the fan group indicated	1...2	1	0	C	V		num
209	CIR_*FANS*_2	Association of *circuit* 2 with the fan group indicated	0...2	1	0	C	V		num
20A	CIR_*FANS*_3	Association of *circuit* 3 with the fan group indicated	0...2	2	0	C	V		num
20B	CIR_*FANS*_4	Association of *circuit* 4 with the fan group indicated	0...2	2	0	C	V		num
20C	CIR_*FANS*_5	Association of *circuit* 5 with the fan group indicated	0...2	0	0	C	V		num
20D	CIR_*FANS*_6	Association of *circuit* 6 with the fan group indicated	0...2	0	0	C	V		num
20E	CIR_*FANS*_7	Association of *circuit* 7 with the fan group indicated	0...2	0	0	C	V		num
20F	CIR_*FANS*_8	Association of *circuit* 8 with the fan group indicated	0...2	0	0	C	V		num
210	KOMP_STAGE_1	Number of *capacity steps* of *compressor* 1	0...3	2	0	C	V		num
211	KOMP_STAGE_2	Number of *capacity steps* of *compressor* 2	0...3	2	0	C	V		num
212	KOMP_STAGE_3	Number of *capacity steps* of *compressor* 3	0...3	2	0	C	V		num
213	KOMP_STAGE_4	Number of *capacity steps* of *compressor* 4	0...3	2	0	C	V		num
214	KOMP_STAGE_5	Number of *capacity steps* of *compressor* 5	0...3	2	0	C	V		num
215	KOMP_STAGE_6	Number of *capacity steps* of *compressor* 6	0...3	2	0	C	V		num
216	KOMP_STAGE_7	Number of *capacity steps* of *compressor* 7	0...3	2	0	C	V		num
217	KOMP_STAGE_8	Number of *capacity steps* of *compressor* 8	0...3	2	0	C	V		num
218	KOMP_TYPE	*Compressor* type. Intervenes on the way of actuating the activation/deactivation sequence of relays associated with the *compressor capacity steps*	0...1	0	12	C	V	0=SEMI-HERMETIC, 1=SCREW	num
219	*FANS*_ASYMMETRICAL_FLAG	*Fans* all the same (NO) or with increasing power (YES). Intervenes on the fan relay activation/deactivation sequence	0...1	0	6	C	V	0=NO, 1=YES	flag
21A	*FANS*_NO_1	Number of *fans* in fan battery 1	1...4	3	0	C	V		num
21B	*FANS*_NO_2	Number of *fans* in fan battery 2	1...4	3	0	C	V		num
21C	*FANS*_NO_3	Number of *fans* in fan battery 3	1...4	1	0	C	N		num
21D	*FANS*_NO_4	Number of *fans* in fan battery 4	1...4	1	0	C	N		num
21E	*FANS*_NO_5	Number of *fans* in fan battery 5	1...4	1	0	C	N		num
21F	*FANS*_NO_6	Number of *fans* in fan battery 6	1...4	1	0	C	N		num
220	*FANS*_NO_7	Number of *fans* in fan battery 7	1...4	1	0	C	N		num
221	*FANS*_NO_8	Number of *fans* in fan battery 8	1...4	1	0	C	N		num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
222	PUMPS_NO	Number of pumps in the system	1...2	2	0	C	V		num
223	PLAN_MODE_DI_ENABLE_FLAG	Enable operating mode setting from digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
224	PLAN_ONOFF_DI_ENABLE_FLAG	Enable remote ON-*OFF* from digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
	High Level								
240	EV_SELECTION_FUNCTION	Selection of policy for refrigerating capacity resources at *evaporator* level	0...1	1	28	C	V	0=SATURATION, 1=BALANCING	flag
241	CIR_SELECTION_FUNCTION	Selection of policy for refrigerating capacity resources at *circuit* level	0...1	1	29	C	V	0=SATURATION, 1=BALANCING	flag
242	KOMP_SELECTION_FUNCTION	Selection policy for refrigerating capacity resources at *compressor* level	0...1	0	30	C	V	0=SATURATION, 1=BALANCING	flag
243	A_HIGHT_ENABLE_FLAG	Enable system *high temperature alarm* (the alarm monitors the primary *circuit* inlet water temperature)	0...1	1	6	C	V	0=NO, 1=YES	flag
244	A_HIGHT_THRESHOLD_TEMP_HOT	System *high temperature alarm* setpoint	-15.0...50.0	18.0	0	H	V		°C
245	A_HIGHT_BYPASS_TIME_HOT	System *high temperature alarm* bypass time	1...99	15	0	H	V		min
246	A_LOWT_ENABLE_FLAG	Enable system *low temperature alarm* (the alarm monitors the primary *circuit* inlet water temperature)	0...1	1	6	C	V	0=NO, 1=YES	Flag
247	A_LOWT_THRESHOLD_TEMP_HOT	System *low temperature alarm* setpoint	-15.0...50.0	30.0	0	H	V		°C
248	A_LOWT_BYPASS_TIME_HOT	System *low temperature alarm* bypass time	1...99	15	0	H	V		min
249	PLAN_MODE_MANUAL_HOT	Summer/winter mode from keypad	0...1	0	27	H	V	0=*CHILLER* 1=HEATPUMP	num
24A	SOFTSTART_TIME_HOT	Time between *compressor* starts	0...10	2	0	H	V		sec
	Temperature *control* configuration								
260	TREG_FUNCTION	Type of temperature *control* 0=Proportional 1=Time-proportional 2=P.I.	0...2	0	17	C	V	0=PROPORTIONAL 1=TIME_PROPORTIONAL, 2=PI	num
261	TREG_TEMP_SENS	Selection of temperature *control* sensor	0...1	0	18	C	V	0=ENTRY_SENSOR, 1=EXIT_SENSOR	num
262	PI_INTEGRAL_COMPONENT_FLAG_HOT	User flag for integral component of P.I. temperature controller	0...1	1	6	H	V	0=NO, 1=YES	flag
263	PI_INTEGRAL_CONSTANT_HOT	Value of time integral for integral component of P.I. temperature controller.	1...900	600	0	H	V		sec
264	PI_PROP_COMPONENT_FLAG_HOT	User flag for proportional component of P.I. temperature controller	0...1	1	6	H	V	0=NO, 1=YES	flag
	Chiller* temperature *control								
270	CH_TSET_TEMP_HOT	Cooling setpoint	CH_MIN_TSET_TEMP.... CH_MAX_TSET_TEMP	7.0	0	H	V		°C
271	CH_MIN_TSET_TEMP	Cooling setpoint minimum value	-50.0...80.0	5.0	0	C	V		°C
272	CH_MAX_TSET_TEMP	Cooling setpoint maximum value	-50.0...80.0	25.0	0	C	V		°C
273	CH_ENTRY_OFFSET_HOT	Cooling setpoint offset if temperature *control* is through the primary *circuit* water inlet temperature sensor	0.0...15.0	0.0	0	H	V		°C
274	CH_PROP_BAND_HOT	Cooling proportional band	CH_MIN_PROP_BAND ...	5.0	0	H	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
			CH_MAX_PROP_BAND						
275	CH_MIN_PROP_BAND	Cooling proportional band minimum value	0.0...25.0	0.0	0	C	V		°C
276	CH_MAX_PROP_BAND	Cooling proportional band maximum value	0.0...25.0	20.0	0	C	V		°C
277	CH_INC_STEP_TIME_HOT	Time between upward steps (refrigerating capacity increments)	0...300	10	0	H	V		sec
278	CH_DEC_STEP_TIME_HOT	Time between downward steps (refrigerating capacity decrements)	0...300	10	0	H	V		sec
	Heat *pump* temperature *control*								
280	HP_TSET_TEMP_HOT	Heating setpoint	HP_MIN_TSET_TEMP ... HP_MAX_TSET_TEMP	40.0	0	H	V		°C
281	HP_MIN_TSET_TEMP	Heating setpoint minimum value	-50.0...150.0	30.0	0	C	V		°C
282	HP_MAX_TSET_TEMP	Heating setpoint maximum value	-50.0...150.0	50.0	0	C	V		°C
283	HP_ENTRY_OFFSET_HOT	Heating offset setpoint if temperature *control* is through the the primary *circuit* water inlet temperature sensor	0.0...15.0	5.0	0	H	V		°C
284	HP_PROP_BAND_HOT	Heating proportional band	HP_MIN_PROP_BAND ... HP_MAX_PROP_BAND	5.0	0	H	V		°C
285	HP_MIN_PROP_BAND	Heating proportional band minimum value	0.0...150.0	5.0	0	C	V		°C
286	HP_MAX_PROP_BAND	Heating proportional band maximum value	0.0...150.0	5.0	0	C	V		°C
287	HP_INC_STEP_TIME_HOT	Time between upward steps (power increments) in *heating mode*	0...300	10	0	H	V		sec
288	HP_DEC_STEP_TIME_HOT	Time between downward steps (power decrements) in *heating mode*	0...300	10	0	H	V		sec
	Dynamic setpoint								
2A0	DTSET_FUNCTION	Enable *dynamic setpoint* function 0=not enabled or none 1=in temperature (not supported) 2=in current	0...2	2	19	C	V	0=NONE, 1=TEMP_FUNCTION, 2=CURRENT_FUNCTION	num
2A1	DTSET_*CHILLER*_MAX_OFFSET	Maximum offset value the *dynamic setpoint* can add to cooling setpoint	-30.0...30.0	6.0	0	C	V		°C
2A2	DTSET_HEATPUMP_MAX_OFFSET	Maximum offset value the *dynamic setpoint* can add from heating setpoint	-30.0...30.0	5.0	0	C	V		°C
	Antifreeze								
2B0	AF_ENABLE_FLAG	Enable *antifreeze function*	0...1	1	6	C	V	0=NO, 1=YES	flag
2B1	AF_USE_RESISTOR_FLAG	Enable use of heaters in case of *antifreeze alarm*	0...1	1	6	C	V	0=NO, 1=YES	flag
2B2	AF_CH_SET_TEMP	*Antifreeze alarm* setpoint	-50.0...150.0	3.0	0	C	V		°C
2B3	AF_CH_DELTA_TEMP	*Antifreeze alarm* delta	0.0...10.0	4.0	0	C	V		°C
2B4	AF_CHILLING_BYPASS_TIME	*Antifreeze alarm* bypass time	0...1000	30	0	C	V		sec
2B5	MAX_AF_ALARMS_NO	Maximum number of *antifreeze alarm*s in the hour before the *antifreeze alarm* changes from automatic to manual	0...1000	0	0	C	V		num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
2B6	AF_HEATING_SET_TEMP	*Antifreeze alarm* setpoint in *heating mode*	-50.0...150.0	1.0	0	C	V		°C
2B7	AF_HEATING_DELTA_TEMP	*Antifreeze alarm* delta in *heating mode*	0.0...10.0	4.0	0	C	V		°C
2B8	AF_HEATING_BYPASS_TIME	Bypass time for *antifreeze alarm* in *heating mode*	0...1000	30	0	C	V		Sec
	***Antifreeze* prevention**								
2C0	AFPR_COOLING_ENABLED_FLAG	Enable *antifreeze* prevention function if the system is on or going *off* (in *Cooling mode* or Going *Off*)	0...1	1	6	C	V	0=NO, 1=YES	Flag
2C1	AFPR_*OFF*_STDBY_ENABLE_FLAG	Enable *antifreeze* prevention function if the system is *off* (*Off* mode)	0...1	1	6	C	V	0=NO, 1=YES	Flag
2C2	AFPR_CHILLING_TSET	*Antifreeze* prevention setpoint	-50.0...150.0	5.0	0	C	V		°C
2C3	AFPR_DELTA_TEMP	*Antifreeze* prevention delta	-50.0...150.0	2.0	0	C	V		°C
2C4	AFPR_ENABLED_DURING_*DEFROST*	Enable *antifreeze* prevention if the system is defrosting	0...1	0	6	C	V	0=NO, 1=YES	flag
2C5	AFPR_ENABLED_DURING_HEATING	Enable *antifreeze* prevention function if the system is on or going *off* in *heating mode*	0...1	0	6	C	V	0=NO, 1=YES	flag
2C6	AFPR_HEATING_TSET	*Antifreeze* prevention setpoint in *heating mode*	-50.0...150.0	5.0	0	C	V		°C
	Circuit								
2E0	A_MAX_PRES	*Circuit* maximum pressure alarm setpoint	0.0...50.0	28.0	0	C	V		Bar
2E1	A_MAX_DELTA_PRES	*Circuit* maximum pressure alarm Delta	0.0...10.0	2.0	0	C	V		Bar
2E2	MAX_MINP_ALARMS_NO_HOT	Maximum number of minimum pressure alarms in the hour before the alarm changes from automatic to manual	0...20	3	0	H	V		num
2E3	A_MIN_PRES_BYPASS_TIME_HOT	Minimum pressure alarm bypass time	0....500	120	0	H	V		sec
	Compressor								
2F0	MIN_OFFON_TIME_HOT	*Compressor* safety time from *OFF* to ON	0...500	60	0	H	V		sec
2F1	MIN_ONOFF_TIME_HOT	*Compressor* safety time from ON to *OFF*	0...500	10	0	H	V		sec
2F2	MAX_STARTS_PER_HOUR_NO_HOT	Maximum number of *compressor* starts in the hour	0...20	6	0	H	V		num
2F3	CPWR_UPDOWN_MIN_TIME_HOT	Safety time between power decrement steps	0...30	10	0	H	V		sec
2F4	CPWR_DOWNUP_MIN_TIME_HOT	Safety time between power increment steps	0...300	10	0	H	V		sec
2F5	A_DISCHARGE_ENABLE_FLAG	Enable *compressor discharge temperature alarm*	0...1	1	6	C	V	0=NO, 1=YES	flag
2F6	A_DISCHARGE_TEMP	*Compressor discharge temperature alarm* setpoint	40.0...150.0	125.0	0	C	V		°C
2F7	A_DISCHARGE_DELTA_TEMP	*Compressor discharge temperature alarm* Delta	0.0...30.0	30.0	0	C	V		°C
2F8	A_KOMP_THER_ENABLE_FLAG	Enable *compressor thermal protection alarm*	0...1	1	6	C	V	0=NO, 1=YES	flag
2F9	KOMP_SWAP_ENABLE_FLAG	Enable *compressor swap* function	0...1	0	6	C	V	0=NO, 1=YES	flag
2FA	SINGLE_KOMP_ON_MAX_TIME_HOT	*Compressor* maximum continuous On time to enable swap	0...300	100	0	H	V		Hour
2FB	SINGLE_KOMP_*OFF*_MIN_TIME_HOT	*Compressor* minimum *Off* time to enable swap	0...300	100	0	H	V		Hour
	Liquid injection								
310	LI_ENABLE_FLAG	Enable liquid injection function	0...1	1	6	C	V	0=NO, 1=YES	flag
311	LI_TSET_TEMP	Liquid injection function setpoint	0.0...150.0	115.	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
				0					
312	LI_DELTA_TEMP	Liquid injection function delta	0.0...10.0	10.0	0	C	V		°C
	Compressor selection								
320	KOMP_SELEZ_1_HOT	Select *compressor* 1	0...1	1	6	H	V	0=NO, 1=YES	flag
321	KOMP_SELEZ_2_HOT	Select *compressor* 2	0...1	1	6	H	V	0=NO, 1=YES	flag
322	KOMP_SELEZ_3_HOT	Select *compressor* 3	0...1	1	6	H	V	0=NO, 1=YES	flag
323	KOMP_SELEZ_4_HOT	Select *compressor* 4	0...1	1	6	H	V	0=NO, 1=YES	flag
324	KOMP_SELEZ_5_HOT	Select *compressor* 5	0...1	1	6	H	V	0=NO, 1=YES	flag
325	KOMP_SELEZ_5_HOT	Select *compressor* 6	0...1	1	6	H	V	0=NO, 1=YES	flag
326	KOMP_SELEZ_7_HOT	Select *compressor* 7	0...1	1	6	H	V	0=NO, 1=YES	flag
327	KOMP_SELEZ_8_HOT	Select *compressor* 8	0...1	1	6	H	V	0=NO, 1=YES	flag
	***Compressor* use time**								
330	KOMP_USAGE_DAYS_1	Days of use of *compressor* 1	0...32000	0	0	C	V		day
331	KOMP_USAGE_DAYS_2	Days of use of *compressor* 2	0...32000	0	0	C	V		day
332	KOMP_USAGE_DAYS_3	Days of use of *compressor* 3	0...32000	0	0	C	V		day
333	KOMP_USAGE_DAYS_4	Days of use of *compressor* 4	0...32000	0	0	C	V		day
334	KOMP_USAGE_DAYS_5	Days of use of *compressor* 5	0....32000	0	0	C	V		day
335	KOMP_USAGE_DAYS_6	Days of use of *compressor* 6	0...32000	0	0	C	V		day
336	KOMP_USAGE_DAYS_7	Days of use of *compressor* 7	0...32000	0	0	C	V		day
337	KOMP_USAGE_DAYS_8	Days of use of *compressor* 8	0...32000	0	0	C	V		day
338	KOMP_USAGE_HOUR_1	Hours of use of *compressor* 1	0...24	0	0	C	V		hour
339	KOMP_USAGE_HOUR_2	Hours of use of *compressor* 2	0...24	0	0	C	V		hour
33A	KOMP_USAGE_HOUR_3	Hours of use of *compressor* 3	0...24	0	0	C	V		hour
33B	KOMP_USAGE_HOUR_4	Hours of use of *compressor* 4	0...24	0	0	C	V		hour
33C	KOMP_USAGE_HOUR_5	Hours of use of *compressor* 5	0...24	0	0	C	V		hour
33D	KOMP_USAGE_HOUR_6	Hours of use of *compressor* 6	0...24	0	0	C	V		hour
33E	KOMP_USAGE_HOUR_7	Hours of use of *compressor* 7	0...24	0	0	C	V		hour
33F	KOMP_USAGE_HOUR_8	Hours of use of *compressor* 8	0...24	0	0	C	V		hour
	Fan regulator configuration								
340	*FANS*_KOMP_DEPENDENCY_FLAG	If NO, the fan battery *fans* operate independently of the status of the compressors of the circuits whose condensation is controlled by the batteries, otherwise at least one of these compressors must be on so that battery fan *control* can be effected.	0...1	1	6	C	V	0=NO, 1=YES	flag
341	*FANS*_CH_INIT_MAX_POWER_TIME	The time the fan battery *fans* operate at full power whenever the battery is started in *cooling mode*	0...120	60	0	C	V		sec

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
342	*FANS*_HP_INIT_MAX_POWER_TIME	The time the fan battery *fans* operate at full power whenever the battery is started in *heating mode*	0...120	60	0	C	V		sec
343	*FANS_CONTROL*_FUNCTION	Selection of type of fan *control* and actuation	0...1	0	31	C	V	0=CONT, 1=DIGITAL	flag
344	CUTOFF_CH_ENABLED_FLAG	Enable CUTOFF in *Chiller* mode	0...1	1	6	C	V	0=NO, 1=YES	flag
345	CUTOFF_HP_ENABLED_FLAG	Enable CUTOFF in Heat *pump* mode	0...1	1	6	C	V	0=NO, 1=YES	flag
346	*FANS_CONTROL*_INPUT_SOURCE	Sensor for *condensation control*	0...1	1	24	C	V	0=temperature 1=pressare	num
	Digital fan regulator in *Chiller*								
360	*FANS*_CSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in *cooling mode*	0.0...50.0	13.0	0	C	V		Bar
361	*FANS*_CSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in *cooling mode*	0.0...50.0	15.0	0	C	V		Bar
362	*FANS*_CSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in *cooling mode*	0.0...50.0	17.0	0	C	V		Bar
363	*FANS*_CSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in *cooling mode*	0.0...50.0	19.0	0	C	V		Bar
364	*FANS*_CSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
365	*FANS*_CSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
366	*FANS*_CSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
367	*FANS*_CSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in *cooling mode*	0.0...50.0	0.0	0	C	V		Bar
368	*FANS*_CSTOP_DELTA1_PRES	Pressure Delta for deactivating ventilation step 1 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
369	*FANS*_CSTOP_DELTA2_PRES	Pressure Delta for deactivating ventilation step 2 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36A	*FANS*_CSTOP_DELTA3_PRES	Pressure Delta for deactivating ventilation step 3 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36B	*FANS*_CSTOP_DELTA4_PRES	Pressure Delta for deactivating ventilation step 4 in *cooling mode*	0.0...10.0	2.0	0	C	V		Bar
36C	*FANS*_CSTOP_DELTA5_PRES	Pressure Delta for deactivating ventilation step 5 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36D	*FANS*_CSTOP_DELTA6_PRES	Pressure Delta for deactivating ventilation step 6 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36E	*FANS*_CSTOP_DELTA7_PRES	Pressure Delta for deactivating ventilation step 7 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
36F	*FANS*_CSTOP_DELTA8_PRES	Pressure Delta for deactivating ventilation step 8 in *cooling mode*	0.0...10.0	0.0	0	C	V		Bar
370	*FANS*_CSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in *cooling mode*	-50.0....150.0	18.0	0	C	V		°C
371	*FANS*_CSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in *cooling mode*	-50.0....150.0	25.0	0	C	V		°C
372	*FANS*_CSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in *cooling mode*	-50.0...150.0	35.0	0	C	V		°C
373	*FANS*_CSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in *cooling mode*	-50.0....150.0	40.0	0	C	V		°C
374	*FANS*_CSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in *cooling mode*	-50.0...150.0	0.0	0	C	V		°C
375	*FANS*_CSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in *cooling mode*	-50.0....150.0	0.0	0	C	V		°C
376	*FANS*_CSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in *cooling mode*	-50.0....150.0	0.0	0	C	V		°C
377	*FANS*_CSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in *cooling mode*	-50.0...150.0	0.0	0	C	V		°C
378	*FANS*_CSTOP_DELTA1_TEMP	Temperature Delta for deactivating ventilation step 1 in *cooling mode*	0.0....25.5	2.0	0	C	V		°C
379	*FANS*_CSTOP_DELTA2_TEMP	Temperature Delta for deactivating ventilation step 2 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C
37A	*FANS*_CSTOP_DELTA3_TEMP	Temperature Delta for deactivating ventilation step 3 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
37B	*FANS*_CSTOP_DELTA4_TEMP	Temperature Delta for deactivating ventilation step 4 in *cooling mode*	0.0...25.5	2.0	0	C	V		°C
37C	*FANS*_CSTOP_DELTA5_TEMP	Temperature Delta for deactivating ventilation step 5 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37D	*FANS*_CSTOP_DELTA6_TEMP	Temperature Delta for deactivating ventilation step 6 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37E	*FANS*_CSTOP_DELTA7_TEMP	Temperature Delta for deactivating ventilation step 7 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
37F	*FANS*_CSTOP_DELTA8_TEMP	Temperature Delta for deactivating ventilation step 8 in *cooling mode*	0.0...25.5	0.0	0	C	V		°C
	Continuous fan regulator in *Chiller* mode								
3A0	*FANS*_CH_MIN_ON_TIME	Minimum ventilation On time in *Chiller* mode at least at minimum speed	0...120	30	0	C	V		sec
3A1	CUTOFF_CH_SETPOINT1_PRES	Pressure value below which the CUTOFF switches *off* ventilation in *Chiller* mode	0.0...60.0	8.0	0	C	V		Bar
3A2	CUTOFF_CH_DELTA1_PRES	Pressure value to be added to CUTOFF_CH_SETPOINT1_PRES. If the ventilation *control* pressure exceeds the total, the *control* changes from ON/*OFF* (due to CUTOFF) to continuous in *Chiller* mode	0.0...10.0	1.0	0	C	V		Bar
3A3	*FANS*_CH_START_PRES	Pressure value at which modulated ventilation *control* starts in *Chiller* mode. Ventilation speed, in percentage, of ventilation is equal to the value of parameter *FANS*_CH_MIN_SPEED	0.0...60.0	10.0	0	C	V		Bar
3A4	*FANS*_CH_SATURATION_PRES	Pressure value at which fan speed goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Chiller* mode	0.0...60.0	20.0	0	C	V		Bar
3A5	*FANS*_CH_MIN_SPEED	Percentage value of minimum ventilation speed in *Chiller* mode	0...100	20	0	C	V		%
3A6	*FANS*_CH_MAX_SPEED	Percentage value of maximum ventilation speed in *Chiller* mode	0...100	80	0	C	V		%
3A7	CUTOFF_CH_SETPOINT2_PRES	Pressure value below which the saturation CUTOFF changes the *control* from ON/*OFF* (due to saturation CUTOFF) to continuous in *Chiller* mode	0.0...60.0	21.0	0	C	V		Bar
3A8	CUTOFF_CH_DELTA2_PRES	Pressure value to be added to CUTOFF_CH_SETPOINT2_PRES. If the ventilation *control* pressure exceeds the total, the fan speed will be equal to the value of parameter *FANS*_CH_SAT_SPEED.	0.0...10.0	1.0	0	C	V		Bar
3A9	*FANS*_CH_SAT_SPEED	Percentage value of maximum ventilation speed in *Chiller* mode	0...100	90	0	C	V		%
3AA	CUTOFF_CH_SETPOINT1_TEMP	Temperature value below which CUTOFF at minimum switches *off* ventilation in *Chiller* mode	-50.0...150.0	16.0	0	C	V		°C
3AB	CUTOFF_CH_DELTA1_TEMP	Temperature value to be added to CUTOFF_CH_SETPOINT1_TEMP. If the ventilation *control* temperature exceeds this total, the *control* changes from ON/*OFF* (due to CUTOFF at minimum) to continuous in *Chiller* mode	0.0...25.5	1.0	0	C	V		°C
3AC	*FANS*_CH_START_TEMP	Temperature value at which modulated ventilation *control* starts in *Chiller* mode. Ventilation speed, in percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	-50.0...150.0	18.0	0	C	V		°C
3AD	*FANS*_CH_SATURATION_TEMP	Temperature value at which ventilation goes to the maximum speed defined by parameter *FANS*_CH_MAX_SPEED in *Chiller* mode	-50.0...150.0	50.0	0	C	V		°C
3AE	CUTOFF_CH_SETPOINT2_TEMP	Temperature value below which saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Chiller* mode	-50.0...150.0	51.0	0	C	V		°C
3AF	CUTOFF_CH_DELTA2_TEMP	Temperature value to be added to CUTOFF_CH_SETPOINT2_TEMP. If the ventilation *control* temperature exceeds the total, the fan speed will be equal to the parameter *FANS*_CH_SAT_SPEED.	0.0...25.5	1.0	0	C	V		°C
	Digital fan regulator in Heat *pump* mode								
3C0	*FANS*_HSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in *heating mode*	0.0...50.0	12.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
3C1	*FANS*_HSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in *heating mode*	0.0...50.0	10.0	0	C	V		Bar
3C2	*FANS*_HSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in *heating mode*	0.0...50.0	8.0	0	C	V		Bar
3C3	*FANS*_HSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in *heating mode*	0.0...50.0	6.0	0	C	V		Bar
3C4	*FANS*_HSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C5	*FANS*_HSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C6	*FANS*_HSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C7	*FANS*_HSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in *heating mode*	0.0...50.0	0.0	0	C	V		Bar
3C8	*FANS*_HSTOP_DELTA1_PRES	Pressure Delta for deactivating ventilation step 1 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3C9	*FANS*_HSTOP_DELTA2_PRES	Pressure Delta for deactivating ventilation step 2 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CA	*FANS*_HSTOP_DELTA3_PRES	Pressure Delta for deactivating ventilation step 3 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CB	*FANS*_HSTOP_DELTA4_PRES	Pressure Delta for deactivating ventilation step 4 in *heating mode*	0.0...10.0	2.0	0	C	V		Bar
3CC	*FANS*_HSTOP_DELTA5_PRES	Pressure Delta for deactivating ventilation step 5 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CD	*FANS*_HSTOP_DELTA6_PRES	Pressure Delta for deactivating ventilation step 6 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CE	*FANS*_HSTOP_DELTA7_PRES	Pressure Delta for deactivating ventilation step 7 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3CF	*FANS*_HSTOP_DELTA8_PRES	Pressure Delta for deactivating ventilation step 8 in *heating mode*	0.0...10.0	0.0	0	C	V		Bar
3D0	*FANS*_HSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in *heating mode*	-50.0...150.0	40.0	0	C	V		°C
3D1	*FANS*_HSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in *heating mode*	-50.0...150.0	35.0	0	C	V		°C
3D2	*FANS*_HSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in *heating mode*	-50.0...150.0	25.0	0	C	V		°C
3D3	*FANS*_HSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in *heating mode*	-50.0...150.0	18.0	0	C	V		°C
3D4	*FANS*_HSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D5	*FANS*_HSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D6	*FANS*_HSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D7	*FANS*_HSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in *heating mode*	-50.0...150.0	0.0	0	C	V		°C
3D8	*FANS*_HSTOP_DELTA1_TEMP	Temperature Delta for deactivating ventilation step 1 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3D9	*FANS*_HSTOP_DELTA2_TEMP	Temperature Delta for deactivating ventilation step 2 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DA	*FANS*_HSTOP_DELTA3_TEMP	Temperature Delta for deactivating ventilation step 3 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DB	*FANS*_HSTOP_DELTA4_TEMP	Temperature Delta for deactivating ventilation step 4 in *heating mode*	0.0...25.5	2.0	0	C	V		°C
3DC	*FANS*_HSTOP_DELTA5_TEMP	Temperature Delta for deactivating ventilation step 5 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DD	*FANS*_HSTOP_DELTA6_TEMP	Temperature Delta for deactivating ventilation step 6 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DE	*FANS*_HSTOP_DELTA7_TEMP	Temperature Delta for deactivating ventilation step 7 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
3DF	*FANS*_HSTOP_DELTA8_TEMP	Temperature Delta for deactivating ventilation step 8 in *heating mode*	0.0...25.5	0.0	0	C	V		°C
	Continuous fan regulator in Heat *pump* mode								
400	*FANS*_HP_MIN_ON_TIME	Minimum ventilation On time in Heat *pump* mode at least at minimum speed	0...120	30	0	C	V		sec
401	CUTOFF_HP_SETPOINT1_PRES	Pressure value above which the CUTOFF switches *off* ventilation in *Pump* mode	0.0...60.0	22.0	0	C	V		Bar
402	CUTOFF_HP_DELTA1_PRES	Pressure value to be subtracted from CUTOFF_CH_SETPOINT1_PRES. If the ventilation *control* pressure goes below the difference, the *control* changes from ON/*OFF* (due to CUTOFF) to continuous in *Pump* mode	0.0...10.0	1.0	0	C	V		Bar
403	*FANS*_HP_START_PRES	Pressure value at which modulated fan *control* is started in *Pump* mode. The fan speed, in percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	0.0...60.0	20.0	0	C	V		Bar
404	*FANS*_HP_SATURATION_PRES	Pressure value at which ventilation goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Pump* mode	0.0...60.0	10.0	0	C	V		Bar
405	*FANS*_HP_MIN_SPEED	Percentage value of minimum ventilation speed in *Pump* mode	0...100	40	0	C	V		%

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406	*FANS*_HP_MAX_SPEED	Percentage value of maximum ventilation speed in *Pump* mode	0...100	80	0	C	V		%
407	CUTOFF_HP_SETPOINT2_PRES	Pressure value above which the saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Pump* mode.	0.0...60.0	9.0	0	C	V		Bar
408	CUTOFF_HP_DELTA2_PRES	Pressure value to be subtracted from CUTOFF_HP_SETPOINT2_PRES. If the ventilation *control* pressure is below this value, the fan speed will be equal to parameter *FANS*_HP_SAT_SPEED.	0.0...10.0	1.0	0	C	V		Bar
409	*FANS*_HP_SAT_SPEED	Percentage value of maximum ventilation speed in *Pump* mode	0...100	90	0	C	V		%
40A	CUTOFF_HP_SETPOINT1_TEMP	Temperature value below which the CUTOFF switches *off* ventilation in *Pump* mode	-50.0...150.0	52.0	0	C	V		°C
40B	CUTOFF_HP_DELTA1_TEMP	Temperature value in *heating mode* to be subtracted from CUTOFF_HP_SETPOINT1_TEMP. If the ventilation *control* temperature goes below the difference, the *control* changes from ON/*OFF* (due to CUTOFF) to continuous in *Pump* mode	0.0...25.5	1.0	0	C	V		°C
40C	*FANS*_HP_START_TEMP	Temperature value at which modulated ventilated *control* is started in *Pump* mode. Ventilation speed, in percentage, is equal to the value of parameter *FANS*_CH_MIN_SPEED	-50.0...150.0	50.0	0	C	V		°C
40D	*FANS*_HP_SATURATION_TEMP	Temperature value at which ventilation goes to the maximum value defined by parameter *FANS*_CH_MAX_SPEED in *Pump* mode	-50.0...150.0	18.0	0	C	V		°C
40E	CUTOFF_HP_SETPOINT2_TEMP	Temperature value above which saturation CUTOFF changes the *control* from ON/*OFF* (due to CUTOFF at saturation) to continuous in *Pump* mode.	-50.0...150.0	17.0	0	C	V		°C
40F	CUTOFF_HP_DELTA2_TEMP	Temperature value in *Pump* mode to be subtracted from CUTOFF_HP_SETPOINT2_TEMP. If the ventilation *control* temperature is below this value, the fan speed will be equal to parameter *FANS*_HP_SAT_SPEED.	0.0...25.5	1.0	0	C	V		°C
	Defrost								
420	DF_FUNCTION	Enable *defrost:* NONE = not enabled Standard = enabled in Energy400 (ECH400) mode	4...5	4	23	C	V	4=Standard, 5=NONE	num
421	DF_MAX_POWER_FLAG	Enable maximum power demand for circuits not defrosting	0...1	0	6	C	V	0=NO, 1=YES	Flag
422	DF_DRIP_*FANS*_MAXPOWER_FLAG	Enable ventilation at maximum power during dripping	0...1	0	6	C	V	0=NO, 1=YES	Flag
423	DF_MIN_REST_TIME	Minimum time between successive defrosts	0...1000	240	0	C	V		Min
424	DF_DRIP_TIME	Drip time.	0...1000	20	0	C	V		Sec
425	DF_INTER_STEP_TIME	Time between *compressor* steps during Energy 400 *defrost*	0....1000	30	0	C	V		Sec
426	DF_INVERSION_TIME	Time - between *circuit* going *off* for defrosting and the *reversing valve* switchover - between *reversing valve* switchover and start of *circuit defrost*	0...1000	30	0	C	V		Sec
427	DF_START_PRES	Pressure value at which *defrost* is activated if the pressure	0.0...50.0	3.0	0	C	V		Bar

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		remains below this value for time DF_START_DELAY_TIME							
428	DF_START_DELAY_TIME	Delay time before start of *defrost* when the pressure remains below the value of parameter DF_START_PRES	0...60	30	0	C	V		Min
429	DF_STOP_PRES	*Defrost* stop pressure value	0.0...50.0	12.0	0	C	V		Bar
42A	DF_MIN_DURATION_TIME	Minimum *defrost* duration time	0....30	5	0	C	V		Min
42B	DF_MAX_DURATION_TIME	Maximum *defrost* duration time	0...60	30	0	C	V		Min
42C	DF_BYPASS_MIN_TIME	Minimum pressure alarm bypass time at start of *defrost*	0...30	5	0	C	V		Min
42D	DF_MAX_FANSP_PRES	Pressure value above which the *fans* go to full power in *defrost*	0.0...50.0	10.0	0	C	V		Bar
42E	DF_MAX_FANSP_DELTA_PRES	Hysteresis delta relative to parameter DF_MAX_FANSP_PRES	0.0...10.0	2.0	0	C	V		Bar
	***Pump* group and flow switch**								
460	A_FS_BYPASS_STARTUP_TIME	*Flow switch alarm* bypass time	1...99	30	0	C	V		Sec
461	A_FS_ENTRY_TIME	Time the flow switch remains in physical alarm status until the alarm is treated as Present	0...60	10	0	C	V		Sec
462	A_FS_EXIT_TIME	Time the flow switch remains in physical non-alarm status until the alarm is treated as Not Present	0...60	10	0	C	V		Sec
463	PUMPS_ALTERNATION_TIME	*Pump* alternation time	1...1000	72	0	C	V		Hour
464	PUMPGROUP_STARTUP_DELAY_TIME	Time necessary between system ON (which causes activation of the selected *pump*) and start of temperature *control*	0...2000	60	0	C	V		Sec
465	PUMPGROUP_STOP_DELAY_TIME	Time the active *pump* must remain On after a system *Off* request and the last *compressor* goes *off*	0...2000	60	0	C	V		Sec
466	A_FS_AUTOMATIC2MANUAL_TIME	Time after which the *flow switch alarm* changes from automatic to manual (must be greater than time A_FS_EXIT_TIME)	1...60	20	0	C	V		Sec
	***Pump* use time**								
480	*PUMP*_USAGE_DAYS_1	Days of use of *pump* 1	0...32000	0	0	C	V		day
481	*PUMP*_USAGE_DAYS_2	Days of use of *pump* 2	0...32000	0	0	C	V		day
482	*PUMP*_USAGE_HOUR_1	Hours of use of *pump* 1	0...24	0	0	C	V		hour
483	*PUMP*_USAGE_HOUR_1	Hours of use of *pump* 2	0...24	0	0	C	V		Hour
	Pump Down								
490	PD_FUNCTION	Selection of *pump*-down type: not active (NO_PD), at start-up (ON_START), or at start and switching *off* (FULL)	0...2	2	15	C	V	0=NO_PD, 1=ON_START, 2=FULL	Num
491	PD_OFFON_MAX_TIME	Maximum *pump*-down time at start	0...1800	10	0	C	V		Sec
492	PD_ONOFF_MAX_TIME	Maximum *pump*-down time in switching *off*	0...1800	10	0	C	V		Sec
493	PD_A_MAXTIME_ENABLE_FLAG	Enable *pump-down timeout* alarms	0...1	1	6	C	V	0=NO, 1=YES	flag
	Status in EEPROM								
4D0	PLAN_STATUS_HOT	Store system status in EEPROM. 0=*Off*, 2=On	0...2	0	0	H	N		Num
	Alarms and blackbox history								
6F0	E2_HISTORY_OLDEST	Gives the index of the oldest alarm (starting from 0). If the number of alarms entered is less than 50, the index remains at 0.	0...49	0	0	H	N		num

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6F1	E2_HISTORY_NUM	Number of alarms entered in the alarms history. If zero, the history is empty. If 50, the history is full.	0...60	0	0	H	N		num
6F2	E2_HISTORY_1	Alarm history 20-character string, with value 0. For example, if E2_HISTORY_OLDEST is 0 and E2_HISTORY_NUM is not 0, this string represents the oldest alarm	x...x	(*)	7	H	V		x
:									
723	E2_HISTORY_50	Alarm history 20-character string, with value 49. For example, if E2_HISTORY_OLDEST is 49 and E2_HISTORY_NUM is not 0, this string represents the oldest alarm	x...x	(*)	7	H	V		x
724	E2_BBX_FILE_OLDEST	Represents the index of the oldest file (starting from 0), if the blackbox is recycling. If the number of files present is less than 3, it must not be considered, as the oldest file is always 000.txt.	0...2	0	0	H	N		num
725	E2_BBX_FILE_NUM	Number of files entered in the blackbox. If zero, the blackbox is empty. If 3, it is full.	0...3	0	0	H	N		num
726	BBX_ENABLE_FLAG	Enable blackbox	0...1	0	6	C	V		flag
727	BBX_INTERVAL_TIME	Sampling interval for blackbox	60...250	60	11	C	V		sec
728	BBX_DELAY	Delay for storing on samples for blackbox	0...20	0	0	C	V		num
729	HISTORY_ENABLE_FLAG	Enable alarm history	0...1	0	6	C	V	0=NO, 1=YES	flag
	Integration								
4C0	INTH_ENABLE_FLAG	Enable integration function	0..1	0	6	C	V	0=NO, 1=YES	Flag
4C1	INTH_DISPATCH_TEMP	Temperature Delta for activating *integrated heaters*	-10.0...10.0	2.0	0	H	V		°C
4C2	INTH_PROP_BAND	Proportional band for activating *integrated heaters*	0.0...30.0	5.0	0	H	V		°C
	Time bands								
7F0	TIME_BAND_ENABLE_FLAG_HOT	Enable *time band management*	0...1	1	6	H	V	0=NO, 1=YES	flag
7F1	TIME_BAND_TYPE	*Time band mode*	0...2	0	0	C	V	0=Daily,1=Weekly, 2=5+2	Num
7F2	TIME_1_BAND1_ENABLE_FLAG	enable band 1 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7F3	TIME_1_BAND1_HOUR	hour for start of band 1 LUN/5D/SETT	0...23	0	0	C	V		Hour
7F4	TIME_1_BAND1_MIN	minutes for start of band 1 LUN/5D/SETT	0...59	0	0	C	V		Min
7F5	TIME_1_BAND1_MODE_HOT	operating mode 1 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
7F6	TIME_1_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7F7	TIME_1_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7F8	TIME_1_BAND2_ENABLE_FLAG	enable band 2 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7F9	TIME_1_BAND2_HOUR	hour for start of band 2 LUN/5D/SETT	0...23	6	0	C	V		Hour
7FA	TIME_1_BAND2_MIN	minutes for start of band 2 LUN/5D/SETT	0...59	0	0	C	V		Min
7FB	TIME_1_BAND2_MODE_HOT	operating mode 2 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF*	Num

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								1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	
7FC	TIME_1_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7FD	TIME_1_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7FE	TIME_1_BAND3_ENABLE_FLAG	enable band 3 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7FF	TIME_1_BAND3_HOUR	hour for start of band 3 LUN/5D/SETT	0...23	12	0	C	V		Hour
800	TIME_1_BAND3_MIN	minutes for start of band 3 LUN/5D/SETT	0...59	0	0	C	V		Min
801	TIME_1_BAND3_MODE_HOT	operating mode 3 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
802	TIME_1_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
803	TIME_1_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
804	TIME_1_BAND4_ENABLE_FLAG	enable band 4 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
805	TIME_1_BAND4_HOUR	hour for start of band 4 LUN/5D/SETT	0...23	18	0	C	V		Hour
806	TIME_1_BAND4_MIN	minutes for start of band 4 LUN/5D/SETT	0...59	0	0	C	V		Min
807	TIME_1_BAND4_MODE_HOT	operating mode 4 LUN/5D/SETT	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
808	TIME_1_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
809	TIME_1_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
80A	TIME_2_BAND1_ENABLE_FLAG	enable band 1 MAR/2D	0...1	1	6	C	V	0=NO, 1=YES	flag
80B	TIME_2_BAND1_HOUR	hour for start of band 1 MAR /2D	0...23	0	0	C	V		Hour
80C	TIME_2_BAND1_MIN	minutes for start of band 1 MAR /2D	0...59	0	0	C	V		Min
80D	TIME_2_BAND1_MODE_HOT	operating mode 1 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
80E	TIME_2_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
80F	TIME_2_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
810	TIME_2_BAND2_ENABLE_FLAG	enable band 2 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
811	TIME_2_BAND2_HOUR	hour for start of band 2 MAR /2D	0...23	6	0	C	V		Hour
812	TIME_2_BAND2_MIN	minutes for start of band 2 MAR /2D	0...59	0	0	C	V		Min
813	TIME_2_BAND2_MODE_HOT	operating mode 2 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE*	Num

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								4=*LOCAL SET*	
814	TIME_2_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
815	TIME_2_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint for band 2 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
816	TIME_2_BAND3_ENABLE_FLAG	enable band 3 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
817	TIME_2_BAND3_HOUR	hour for start of band 3 MAR /2D	0...23	12	0	C	V		Hour
818	TIME_2_BAND3_MIN	minutes for start of band 3 MAR /2D	0...59	0	0	C	V		Min
819	TIME_2_BAND3_MODE_HOT	operating mode 3 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
81A	TIME_2_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
81B	TIME_2_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
81C	TIME_2_BAND4_ENABLE_FLAG	enable band 4 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
81D	TIME_2_BAND4_HOUR	hour for start of band 4 MAR /2D	0...23	18	0	C	V		Hour
81E	TIME_2_BAND4_MIN	minutes for start of band 4 MAR /2D	0...59	0	0	C	V		Min
81F	TIME_2_BAND4_MODE_HOT	operating mode 4 MAR /2D	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
820	TIME_2_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
821	TIME_2_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
822	TIME_3_BAND1_ENABLE_FLAG	enable band 1 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
823	TIME_3_BAND1_HOUR	hour for start of band 1 MER	0...23	0	0	C	V		Hour
824	TIME_3_BAND1_MIN	minutes for start of band 1 MER	0...59	0	0	C	V		Min
825	TIME_3_BAND1_MODE_HOT	operating mode 1 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
826	TIME_3_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 MER	-50.0...150.0	12.0	0	H	V		°C
827	TIME_3_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 MER	-50.0...150.0	40.0	0	H	V		°C
828	TIME_3_BAND2_ENABLE_FLAG	enable band 2 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
829	TIME_3_BAND2_HOUR	hour for start of band 2 MER	0...23	6	0	C	V		Hour
82A	TIME_3_BAND2_MIN	minutes for start of band 2 MER	0...59	0	0	C	V		Min
82B	TIME_3_BAND2_MODE_HOT	operating mode 2 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
82C	TIME_3_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 MER	-50.0...150.0	12.0	0	H	V		°C
82D	TIME_3_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 MER	-50.0...150.0	40.0	0	H	V		°C

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82E	TIME_3_BAND3_ENABLE_FLAG	enable band 3 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
82F	TIME_3_BAND3_HOUR	hour for start of band 3 MER	0...23	12	0	C	V		Hour
830	TIME_3_BAND3_MIN	minutes for start of band 3 MER	0...59	0	0	C	V		Min
831	TIME_3_BAND3_MODE_HOT	operating mode 3 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
832	TIME_3_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 MER	-50.0...150.0	12.0	0	H	V		°C
833	TIME_3_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 MER	-50.0...150.0	40.0	0	H	V		°C
834	TIME_3_BAND4_ENABLE_FLAG	enable band 4 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
835	TIME_3_BAND4_HOUR	hour for start of band 4 MER	0...23	18	0	C	V		Hour
836	TIME_3_BAND4_MIN	hour for start of band 4 MER	0...59	0	0	C	V		Min
837	TIME_3_BAND4_MODE_HOT	operating mode 4 MER	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
838	TIME_3_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 MER	-50.0...150.0	12.0	0	H	V		°C
839	TIME_3_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 MER	-50.0...150.0	40.0	0	H	V		°C
83A	TIME_4_BAND1_ENABLE_FLAG	enable band 1 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
83B	TIME_4_BAND1_HOUR	hour for start of band 1 GIO	0...23	0	0	C	V		Hour
83C	TIME_4_BAND1_MIN	minutes for start of band 1 GIO	0...59	0	0	C	V		Min
83D	TIME_4_BAND1_MODE_HOT	operating mode 1 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
83E	TIME_4_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 GIO	-50.0...150.0	12.0	0	H	V		°C
83F	TIME_4_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 GIO	-50.0...150.0	40.0	0	H	V		°C
840	TIME_4_BAND2_ENABLE_FLAG	enable band 2 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
841	TIME_4_BAND2_HOUR	hour for start of band 2 GIO	0...23	6	0	C	V		Hour
842	TIME_4_BAND2_MIN	minutes for start of band 2 GIO	0...59	0	0	C	V		Min
843	TIME_4_BAND2_MODE_HOT	operating mode 2 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
844	TIME_4_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 GIO	-50.0...150.0	12.0	0	H	V		°C
845	TIME_4_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 GIO	-50.0...150.0	40.0	0	H	V		°C
846	TIME_4_BAND3_ENABLE_FLAG	enable band 3 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
847	TIME_4_BAND3_HOUR	hour for start of band 3 GIO	0...23	12	0	C	V		Hour

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
848	TIME_4_BAND3_MIN	minutes for start of band 3 GIO	0...59	0	0	C	V		Min
849	TIME_4_BAND3_MODE_HOT	operating mode 3 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
84A	TIME_4_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 GIO	-50.0...150.0	12.0	0	H	V		°C
84B	TIME_4_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 GIO	-50.0...150.0	40.0	0	H	V		°C
84C	TIME_4_BAND4_ENABLE_FLAG	enable band 4 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
84D	TIME_4_BAND4_HOUR	hour for start of band 4 GIO	0...23	18	0	C	V		Hour
84E	TIME_4_BAND4_MIN	minutes for start of band 4 GIO	0...59	0	0	C	V		Min
84F	TIME_4_BAND4_MODE_HOT	operating mode 4 GIO	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
850	TIME_4_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 GIO	-50.0...150.0	12.0	0	H	V		°C
851	TIME_4_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 GIO	-50.0...150.0	40.0	0	H	V		°C
852	TIME_5_BAND1_ENABLE_FLAG	enable band 1 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
853	TIME_5_BAND1_HOUR	hour for start of band 1 VEN	0...23	0	0	C	V		Hour
854	TIME_5_BAND1_MIN	minutes for start of band 1 VEN	0...59	0	0	C	V		Min
855	TIME_5_BAND1_MODE_HOT	operating mode 1 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
856	TIME_5_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 VEN	-50.0...150.0	12.0	0	H	V		°C
857	TIME_5_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 VEN	-50.0...150.0	40.0	0	H	V		°C
858	TIME_5_BAND2_ENABLE_FLAG	enable band 2 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
859	TIME_5_BAND2_HOUR	hour for start of band 2 VEN	0...23	6	0	C	V		Hour
85A	TIME_5_BAND2_MIN	minutes for start of band 2 VEN	0...59	0	0	C	V		Min
85B	TIME_5_BAND2_MODE_HOT	operating mode 2 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
85C	TIME_5_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 VEN	-50.0...150.0	12.0	0	H	V		°C
85D	TIME_5_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 VEN	-50.0...150.0	40.0	0	H	V		°C
85E	TIME_5_BAND3_ENABLE_FLAG	enable band 3 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
85F	TIME_5_BAND3_HOUR	hour for start of band 3 VEN	0...23	12	0	C	V		Hour
860	TIME_5_BAND3_MIN	minutes for start of band 3 VEN	0...59	0	0	C	V		Min
861	TIME_5_BAND3_MODE_HOT	operating mode 3 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP*	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
								2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	
862	TIME_5_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 VEN	-50.0...150.0	12.0	0	H	V		°C
863	TIME_5_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 VEN	-50.0...150.0	40.0	0	H	V		°C
864	TIME_5_BAND4_ENABLE_FLAG	enable band 4 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
865	TIME_5_BAND4_HOUR	hour for start of band 4 VEN	0...23	18	0	C	V		Hour
866	TIME_5_BAND4_MIN	minutes for start of band 4 VEN	0...59	0	0	C	V		Min
867	TIME_5_BAND4_MODE_HOT	operating mode 4 VEN	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
868	TIME_5_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 VEN	-50.0...150.0	12.0	0	H	V		°C
869	TIME_5_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 VEN	-50.0...150.0	40.0	0	H	V		°C
86A	TIME_6_BAND1_ENABLE_FLAG	enable band 1 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
86B	TIME_6_BAND1_HOUR	hour for start of band 1 SAB	0...23	0	0	C	V		Hour
86C	TIME_6_BAND1_MIN	minutes for start of band 1 SAB	0...59	0	0	C	V		Min
86D	TIME_6_BAND1_MODE_HOT	operating mode 1 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
86E	TIME_6_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 SAB	-50.0...150.0	12.0	0	H	V		°C
86F	TIME_6_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 SAB	-50.0...150.0	40.0	0	H	V		°C
870	TIME_6_BAND2_ENABLE_FLAG	enable band 2 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
871	TIME_6_BAND2_HOUR	hour for start of band 2 SAB	0...23	6	0	C	V		Hour
872	TIME_6_BAND2_MIN	minutes for start of band 2 SAB	0...59	0	0	C	V		Min
873	TIME_6_BAND2_MODE_HOT	operating mode 2 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
874	TIME_6_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 SAB	-50.0...150.0	12.0	0	H	V		°C
875	TIME_6_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 SAB	-50.0...150.0	40.0	0	H	V		°C
876	TIME_6_BAND3_ENABLE_FLAG	enable band 3 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
877	TIME_6_BAND3_HOUR	hour for start of band 3 SAB	0...23	12	0	C	V		Hour
878	TIME_6_BAND3_MIN	minutes for start of band 3 SAB	0...59	0	0	C	V		Min
879	TIME_6_BAND3_MODE_HOT	operating mode 3 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
87A	TIME_6_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 SAB	-50.0...150.0	12.0	0	H	V		°C
87B	TIME_6_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 SAB	-50.0...150.0	40.0	0	H	V		°C
87C	TIME_6_BAND4_ENABLE_FLAG	enable band 4 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
87D	TIME_6_BAND4_HOUR	hour for start of band 4 SAB	0...23	18	0	C	V		Hour
87E	TIME_6_BAND4_MIN	minutes for start of band 4 SAB	0...59	0	0	C	V		Min
87F	TIME_6_BAND4_MODE_HOT	operating mode 4 SAB	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
880	TIME_6_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 SAB	-50.0...150.0	12.0	0	H	V		°C
881	TIME_6_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 SAB	-50.0...150.0	40.0	0	H	V		°C
882	TIME_7_BAND1_ENABLE_FLAG	enable band 1 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
883	TIME_7_BAND1_HOUR	hour for start of band 1 DOM	0...23	0	0	C	V		Hour
884	TIME_7_BAND1_MIN	minutes for start of band 1 DOM	0...59	0	0	C	V		Min
885	TIME_7_BAND1_MODE_HOT	operating mode 1 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
886	TIME_7_BAND1_CH_TSET_TEMP_HOT	*cooling mode* setpoint 1 DOM	-50.0...150.0	12.0	0	H	V		°C
887	TIME_7_BAND1_HP_TSET_TEMP_HOT	*heating mode* setpoint 1 DOM	-50.0...150.0	40.0	0	H	V		°C
888	TIME_7_BAND2_ENABLE_FLAG	enable band 2 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
889	TIME_7_BAND2_HOUR	hour for start of band 2 DOM	0...23	6	0	C	V		Hour
88A	TIME_7_BAND2_MIN	minutes for start of band 2 DOM	0...59	0	0	C	V		Min
88B	TIME_7_BAND2_MODE_HOT	operating mode 2 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
88C	TIME_7_BAND2_CH_TSET_TEMP_HOT	*cooling mode* setpoint 2 DOM	-50.0...150.0	12.0	0	H	V		°C
88D	TIME_7_BAND2_HP_TSET_TEMP_HOT	*heating mode* setpoint 2 DOM	-50.0...150.0	40.0	0	H	V		°C
88E	TIME_7_BAND3_ENABLE_FLAG	enable band 3 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
88F	TIME_7_BAND3_HOUR	hour for start of band 3 DOM	0...23	12	0	C	V		Hour
890	TIME_7_BAND3_MIN	minutes for start of band 3 DOM	0...59	0	0	C	V		Min
891	TIME_7_BAND3_MODE_HOT	operating mode 3 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
892	TIME_7_BAND3_CH_TSET_TEMP_HOT	*cooling mode* setpoint 3 DOM	-50.0...150.0	12.0	0	H	V		°C
893	TIME_7_BAND3_HP_TSET_TEMP_HOT	*heating mode* setpoint 3 DOM	-50.0...150.0	40.0	0	H	V		°C
894	TIME_7_BAND4_ENABLE_FLAG	enable band 4 DOM	0...1	1	6	C	V	0=NO,	flag

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of transcoding	UM
								1=YES	
895	TIME_7_BAND4_HOUR	hour for start of band 4 DOM	0...23	18	0	C	V		Hour
896	TIME_7_BAND4_MIN	minutes for start of band 4 DOM	0...59	0	0	C	V		Min
897	TIME_7_BAND4_MODE_HOT	operating mode 4 DOM	0...4	0	0	H	V	0=*OFF* 1=*PUMP* 2=*CHILLER* 3=*MANUAL MODE* 4=*LOCAL SET*	Num
898	TIME_7_BAND4_CH_TSET_TEMP_HOT	*cooling mode* setpoint 4 DOM	-50.0...150.0	12.0	0	H	V		°C
899	TIME_7_BAND4_HP_TSET_TEMP_HOT	*heating mode* setpoint 4 DOM	-50.0...150.0	40.0	0	H	V		°C

9 APPENDIX

9.1 User variables

Name	Ind. Modbus [hex]	Inf	Sup	Trans	UM	Description of trans.	Description
PlanStatus_UI	5F0	0	3	7	0	0=MODE_SPENTO, 1=MODE_*CHILLER*, 2=MODE_HEATPUMP 3=MODE_SPEGNIMENTO	System status
CombineAlarm_UI	5F1	0	42	7	0	38=MODE_AL_HARDWARE, 39=MODE_AL_RTC, 40=MODE_AL_CONFIGURATION, 42=MODE_STR_NULL	HW alarm present
PlanTempInWaterSens_1_UI	5F2	-50.0	150.0	0	°C		Primary *circuit* inlet water temperature
PlanTempOutWaterSens_1_UI	5F3	-50.0	150.0	0	°C		Primary *circuit* outlet water temperature
PlanPowPerc_UI	5F4	0	100	0	%		System output percentage
PumpStatus_1_UI	5F5	0	1	5	0	0=*OFF*, 1=ON	*Pump* 1 status
PumpStatus_2_UI	5F6	0	1	5	0	0=*OFF*, 1=ON	*Pump* 2 status
KompStatus_1_UI	5F7	0	9	8	0	0=CMP_0, 1=CMP_25, 2=CMP_33, 3=CMP_50, 4=CMP_6, 5=CMP_75, 6=100, 7=CMP_ALLARME, 8=CMP_DESELEZIONATO, 9=CMP_TEMPI_SICUREZZA	*Compressor* 1 status
KompStatus_2_UI	5F8					"	*Compressor* 2 status
KompStatus_3_UI	5F9					"	*Compressor* 3 status
KompStatus_4_UI	5FA					"	*Compressor* 4 status
KompStatus_5_UI	5FB					"	*Compressor* 5 status
KompStatus_6_UI	5FC					"	*Compressor* 6 status
KompStatus_7_UI	5FD					"	*Compressor* 7 status
KompStatus_8_UI	5FE					"	*Compressor* 8 status
KompTempDischargeSens_1_UI	5FF	-50.0	150.0		°C		*Compressor* 1 discharge temperature
KompTempDischargeSens_2_UI	600	-50.0	150.0		°C		*Compressor* 2 discharge temperature
KompTempDischargeSens_3_UI	601	-50.0	150.0		°C		*Compressor* 3 discharge temperature

Name	Ind. Modbus [hex]	Inf	Sup	Trans	UM	Description of trans.	Description
KompTempDischargeSens_4_UI	602	-50.0	150.0		°C		*Compressor* 4 discharge temperature
KompTempDischargeSens_5_UI	603	-50.0	150.0		°C		*Compressor* 5 discharge temperature
KompTempDischargeSens_6_UI	604	-50.0	150.0		°C		*Compressor* 6 discharge temperature
KompTempDischargeSens_7_UI	605	-50.0	150.0		°C		*Compressor* 7 discharge temperature
KompTempDischargeSens_8_UI	606	-50.0	150.0		°C		*Compressor* 8 discharge temperature
CirPowPerc_1_UI	607	0	100	0	%		*Circuit* 1 output percentage
CirPowPerc_2_UI	608						*Circuit* 2 output percentage
CirPowPerc_3_UI	609						*Circuit* 3 output percentage
CirPowPerc_4_UI	60A						*Circuit* 4 output percentage
CirPowPerc_5_UI	60B						*Circuit* 5 output percentage
CirPowPerc_6_UI	60C						*Circuit* 6 output percentage
CirPowPerc_7_UI	60D						*Circuit* 7 output percentage
CirPowPerc_8_UI	60E						*Circuit* 8 output percentage
CirStatus_1_UI	60F	0	4	9	0	0=CIRC_POTENZA, 1=CIRC_ALLARME, 3=CIRC_POMPDOWN 4=CIRC_*DEFROST*	*Circuit* 1 status
CirStatus_2_UI	610					"	*Circuit* 2 status
CirStatus_3_UI	611					"	*Circuit* 3 status
CirStatus_4_UI	612					"	*Circuit* 4 status
CirStatus_5_UI	613					"	*Circuit* 5 status
CirStatus_6_UI	614					"	*Circuit* 6 status
CirStatus_7_UI	615					"	*Circuit* 7 status
CirStatus_8_UI	616					"	*Circuit* 8 status
CirPresMaxSens_1_UI	617	-50.0	150.0		Bar		*Circuit* 1 maximum pressure sensor
CirPresMaxSens_2_UI	618	-50.0	150.0		Bar		*Circuit* 2 maximum pressure sensor
CirPresMaxSens_3_UI	619	-50.0	150.0		Bar		*Circuit* 3 maximum pressure sensor
CirPresMaxSens_4_UI	61A	-50.0	150.0		Bar		*Circuit* 4 maximum pressure sensor
CirPresMaxSens_5_UI	61B	-50.0	150.0		Bar		*Circuit* 5 maximum pressure sensor
CirPresMaxSens_6_UI	61C	-50.0	150.0		Bar		*Circuit* 6 maximum pressure sensor
CirPresMaxSens_7_UI	61D	-50.0	150.0		Bar		*Circuit* 7 maximum pressure sensor
CirPresMaxSens_8_UI	61E	-50.0	150.0		Bar		*Circuit* 8 maximum pressure sensor
FansPowPerc_1_UI	61F	0	100	0	%		Fan battery 1 output percentage
FansPowPerc_2_UI	620	0	100	0	%		Fan battery 2 output percentage
HistoryMessage1_UI	621						20-character string that displays the alarm index/number of alarms

Name	Ind. Modbus [hex]	Inf	Sup	Trans	UM	Description of trans.	Description
							in history
HistoryMessage1_UI	622						20-character string that displays the alarm history
HistoryLocked	623	0	1				Alarm history “locked” flag
HistoryReqLocked	624	0	1				Alarm history “lock” request flag
BbxLocked	625	0	1				Blackbox “locked” flag
BbxReqLocked	626	0	1				Blackbox “lock” request flag
CirTempCondSens_1_UI	627	-50.0	150.0		°C		*Circuit* 1 condenser temperature sensor
CirTempCondSens_2_UI	628	-50.0	150.0		°C		*Circuit* 2 condenser temperature sensor
CirTempCondSens_3_UI	629	-50.0	150.0		°C		*Circuit* 3 condenser temperature sensor
CirTempCondSens_4_UI	62A	-50.0	150.0		°C		*Circuit* 4 condenser temperature sensor
CirTempCondSens_5_UI	62B	-50.0	150.0		°C		*Circuit* 5 condenser temperature sensor
CirTempCondSens_6_UI	62C	-50.0	150.0		°C		*Circuit* 6 condenser temperature sensor
CirTempCondSens_7_UI	62D	-50.0	150.0		°C		*Circuit* 7 condenser temperature sensor
CirTempCondSens_8_UI	62E	-50.0	150.0		°C		*Circuit* 8 condenser temperature sensor
ActiveTimeBandChSet_UI	62F	-50.0	150.0		°C		Current time band *cooling mode* setpoint
ActiveTimeBandHpSet_UI	630	-50.0	150.0		°C		Current time band *heating mode* setpoint

9.2 User dynamic variables

Index	Var. MenuMaker PRO	Var. Dictionary	Mb Add. [hex]	Function	Description
0	BIOS	VAR_ANA_BIOS_4	380		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16		VAR_ANA_BIOS_5	381		
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30	USERDVFUNCTION_0			*Pump* 1	*Pump* menu item visibility
31	USERDVFUNCTION_1			*Pump* 2	
32	USERDVFUNCTION_2	VAR_ANA_BIOS_6	382	*Circuit* 1	*Circuit* menu item visibility
33	USERDVFUNCTION_3			*Circuit* 2	
34	USERDVFUNCTION_4			*Circuit* 3	
35	USERDVFUNCTION_5			*Circuit* 4	
36	USERDVFUNCTION_6			*Circuit* 5	
37	USERDVFUNCTION_7			*Circuit* 6	
38	USERDVFUNCTION_8			*Circuit* 7	
39	USERDVFUNCTION_9			*Circuit* 8	
40	USERDVFUNCTION_10			*Compressor* 1	*Compressor* menu item visibility
41	USERDVFUNCTION_11			*Compressor* 2	
42	USERDVFUNCTION_12			*Compressor* 3	
43	USERDVFUNCTION_13			*Compressor* 4	
44	USERDVFUNCTION_14			*Compressor* 5	
45	USERDVFUNCTION_15			*Compressor* 6	
46	USERDVFUNCTION_16			*Compressor* 7	

Index	Var. MenuMaker PRO	Var. Dictionary	Mb Add. [hex]	Function	Description
47	USERDVFUNCTION_17			*Compressor* 8	
48	USERDVFUNCTION_18	VAR_ANA_BIOS_7	383	Fan battery 1	Fan menu item visibility
49	USERDVFUNCTION_19			Fan battery 2	
50	USERDVFUNCTION_20			*Cooling mode*	*Cooling mode* delta visibility
51	USERDVFUNCTION_21			*Heating mode*	*Heating mode* delta visibility
52	USERDVFUNCTION_22			Condenser temp.	Condenser temperature sensor visibility
53	USERDVFUNCTION_23			TimeBand-Daily	Daily time band programming
54	USERDVFUNCTION_24			TimeBand-5+2	Time band 5+2 programming
55	USERDVFUNCTION_25			TimeBand-Weekly	Weekly time band programming
56	USERDVFUNCTION_26			Cooling Set by parameter	Visibility of item Cooling Set CH_TSET_TEMP_HOT
57	USERDVFUNCTION_27			Heating Set by parameter	Visibility of item Heating Set HP_TSET_TEMP_HOT
58	USERDVFUNCTION_28			Time band cooling Set	Current time band cooling Set visibility
59	USERDVFUNCTION_29			Time band heating Set	Current time band Heating Set visibility
60	USERDVFUNCTION_30				
61	USERDVFUNCTION_31				
62	USERDVFUNCTION_32				
63	USERDVFUNCTION_33				

9.3 User functions

Index	Var. MenuMaker PRO	Var. Dictionary	Mb Add. [hex]	Function
0	BIOS	VAR_BOO_BIOS_17	14C	
1		VAR_BOO_BIOS_18	14D	
2		VAR_BOO_BIOS_19	14E	
3		VAR_BOO_BIOS_20	14F	
4		VAR_BOO_BIOS_21	150	
5		VAR_BOO_BIOS_22	151	
6		VAR_BOO_BIOS_23	152	
7		VAR_BOO_BIOS_24	153	
8		VAR_BOO_BIOS_25	154	
9	USER FUNCTION 0	VAR_BOO_BIOS_26	155	Alarm reset
10	USER FUNCTION 1	VAR_BOO_BIOS_27	156	Reset hours *pump* 1
11	USER FUNCTION 2	VAR_BOO_BIOS_28	157	Reset hours *pump* 2
12	USER FUNCTION 3	VAR_BOO_BIOS_29	158	Reset hours *compressor* 1
13	USER FUNCTION 4	VAR_BOO_BIOS_30	159	Reset hours *compressor* 2
14	USER FUNCTION 5	VAR_BOO_BIOS_31	15A	Reset hours *compressor* 3
15	USER FUNCTION 6	VAR_BOO_BIOS_32	15B	Reset hours *compressor* 4
16	USER FUNCTION 7	VAR_BOO_BIOS_33	15C	Reset hours *compressor* 5
17	USER FUNCTION 8	VAR_BOO_BIOS_34	15D	Reset hours *compressor* 6
18	USER FUNCTION 9	VAR_BOO_BIOS_35	15E	Reset hours *compressor* 7
19	USER FUNCTION 10	VAR_BOO_BIOS_36	15F	Reset hours *compressor* 8
20	USER FUNCTION 11	VAR_BOO_BIOS_37	160	Reset alarm history
21	USER FUNCTION 12	VAR_BOO_BIOS_38	161	Display next element in alarm history
22	USER FUNCTION 13	VAR_BOO_BIOS_39	162	Delete blackbox files

9.4 I/O map

The following tables describe the wiring for the maximum machine that can be defined with the current application.

9.4.1 XTMRH

NO1	PLAN_CUMALARM_DO_PHY	Cumulative machine alarm
NO2	EV_HEATER_DO_1_PHY	Primary *circuit antifreeze* heater *evaporator* 1
NO3	EV_HEATER_DO_2_PHY	Primary *circuit antifreeze* heater *evaporator* 2
NO4	KOMP_ACC_DO_1_PHY	*Compressor* 1 starts
NO5	KOMP_ACC_DO_2_PHY	*Compressor* 2 starts
NO6	KOMP_ACC_DO_3_PHY	*Compressor* 3 starts
NO7	KOMP_ACC_DO_4_PHY	*Compressor* 4 starts
NO8	KOMP_PW_DO_1_PHY	*Compressor* 1 part winding
NO9	KOMP_PW_DO_2_PHY	*Compressor* 2 part winding
NO10	KOMP_PW_DO_3_PHY	*Compressor* 3 part winding
NO11	KOMP_PW_DO_4_PHY	*Compressor* 4 part winding
NO12	KOMP_PARZ1_DO_1_PHY	Capacity step 1 of *compressor* 1
NO13	KOMP_PARZ2_DO_1_PHY	Capacity step 2 of *compressor* 1
NO14	KOMP_PARZ1_DO_2_PHY	Capacity step 1 of *compressor* 2
NO15	KOMP_PARZ2_DO_2_PHY	Capacity step 2 of *compressor* 2
NO17	KOMP_PARZ1_DO_3_PHY	Capacity step 1 of *compressor* 3
NO18	KOMP_PARZ2_DO_3_PHY	Capacity step 2 of *compressor* 3
NO18	KOMP_PARZ1_DO_4_PHY	Capacity step 1 of *compressor* 4
NO19	KOMP_PARZ2_DO_4_PHY	Capacity step 2 of *compressor* 4
NO20	*PUMP*_ACC_DO_1_PHY	Primary water *circuit* pumps
AI1	PLAN_TEMP_INWATER_SENS_PHY	Primary *circuit* inlet temperature sensor
AI2	EV_TEMP_OUTWATER_SENS_1_PHY	Primary *circuit* outlet temperature sensor *evaporator* 1
AI3	EV_TEMP_OUTWATER_SENS_2_PHY	Primary *circuit* outlet temperature sensor *evaporator* 2
AI4	PLAN_TEMP_OUTWATER_SENS_PHY	Primary *circuit* outlet temperature common sensor
AI5	CIR_PRES_MAX_SENS_1_PHY	*Circuit* 1 maximum pressure analogue sensor
AI6	CIR_PRES_MAX_SENS_2_PHY	*Circuit* 2 maximum pressure analogue sensor
AI7	CIR_PRES_MAX_SENS_3_PHY	*Circuit* 3 maximum pressure analogue sensor
AI8	CIR_PRES_MAX_SENS_4_PHY	*Circuit* 4 maximum pressure analogue sensor
AI9	PLAN_CURR_DTSET_SENS_PHY	Current sensor for dynamic Tset
AI13	KOMP_TEMP_DISCHARGE_SENS_1_PHY	*Compressor* 1 discharge temperature analogue sensor
AI14	KOMP_TEMP_DISCHARGE_SENS_2_PHY	*Compressor* 2 discharge temperature analogue sensor
AI15	KOMP_TEMP_DISCHARGE_SENS_3_PHY	*Compressor* 3 discharge temperature analogue sensor
AI16	KOMP_TEMP_DISCHARGE_SENS_4_PHY	*Compressor* 4 discharge temperature analogue sensor
IDL1	CIR_PRES_MAX_DI_1_PHY	*Circuit* 1 maximum pressure switch
IDL2	CIR_PRES_MAX_DI_2_PHY	*Circuit* 2 maximum pressure switch
IDL3	CIR_PRES_MAX_DI_3_PHY	*Circuit* 3 maximum pressure switch
IDL4	CIR_PRES_MAX_DI_4_PHY	*Circuit* 4 maximum pressure switch
IDL5	CIR_PRES_MIN_DI_1_PHY	*Circuit* 1 minimum pressure switch
IDL6	CIR_PRES_MIN_DI_2_PHY	*Circuit* 2 minimum pressure switch
IDL7	CIR_PRES_MIN_DI_3_PHY	*Circuit* 3 minimum pressure switch
IDL8	CIR_PRES_MIN_DI_4_PHY	*Circuit* 4 minimum pressure switch
IDL9	KOMP_A_THER_DI_1_PHY	*Compressor* 1 motor digital temperature input
IDL10	KOMP_A_THER_DI_2_PHY	*Compressor* 2 motor digital temperature input
IDL11	KOMP_A_THER_DI_3_PHY	*Compressor* 3 motor digital temperature input
IDL12	KOMP_A_THER_DI_4_PHY	*Compressor* 4 motor digital temperature input
IDL13	*PUMP*_A_FLOW_DI_PHY	Primary *circuit* flow switch
IDL14	*FANS*_A_THER_DI_1_PHY	Fan battery 1 thermal protection alarm
IDL15	*FANS*_A_THER_DI_2_PHY	Fan battery 2 thermal protection alarm
IDL16	PLAN_ON_DI_PHY	Remote On/*Off*
IDL17	*PUMP*_A_THER_DI_1_PHY	Primary *circuit pump* 1 thermal protection alarm
IDL18	*PUMP*_A_THER_DI_2_PHY	Primary *circuit pump* 2 thermal protection alarm
IDL19	PLAN_MODE_DI_PHY	Summer/winter switchover
AO1	*FANS*_CTRL_AO_1_PHY	Fan battery 1 analogue fan speed *control*
AO2	*FANS*_CTRL_AO_2_PHY	Fan battery 2 analogue fan speed *control*

9.4.2 XTEH (address 1)

NO1	*PUMP*_ACC_DO_2_PHY	Primary water *circuit* pumps
NO2	KOMP_IL_DO_1_PHY	*Compressor* 1 liquid injection
NO3	KOMP_IL_DO_2_PHY	*Compressor* 2 liquid injection
NO4	KOMP_IL_DO_3_PHY	*Compressor* 3 liquid injection
NO5	KOMP_IL_DO_4_PHY	*Compressor* 4 liquid injection
NO6	CIR_SOLENOID_VALVE_DO_1_PHY	*Circuit* 1 solenoid valve
NO7	CIR_SOLENOID_VALVE_DO_2_PHY	*Circuit* 2 solenoid valve
NO8	CIR_SOLENOID_VALVE_DO_3_PHY	*Circuit* 3 solenoid valve
NO9	CIR_SOLENOID_VALVE_DO_4_PHY	*Circuit* 4 solenoid valve
NO10	*FANS*_ACC1_DO_1_PHY	Fan battery 1, start fan 1
NO11	*FANS*_ACC2_DO_1_PHY	Fan battery 1, start fan 2
NO12	*FANS*_ACC3_DO_1_PHY	Fan battery 1, start fan 3
NO13	*FANS*_ACC4_DO_1_PHY	Fan battery 1, start fan 4
NO14	*FANS*_ACC1_DO_2_PHY	Fan battery 2, start fan 1
NO15	*FANS*_ACC2_DO_2_PHY	Fan battery 2, start fan 2

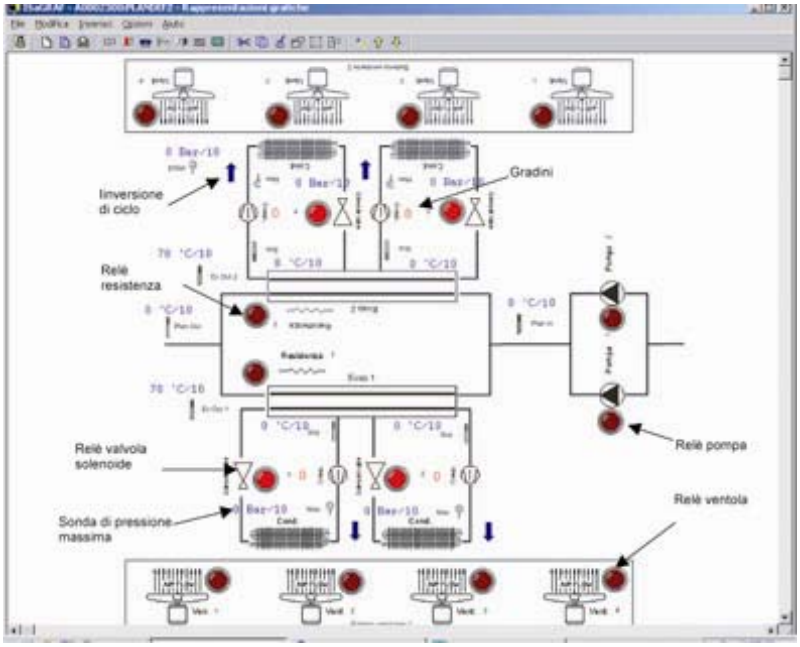
9.4.3 XTEH (address 2)

NO1	*FANS*_ACC3_DO_2_PHY	Fan battery 2, start fan 3
NO2	*FANS*_ACC4_DO_2_PHY	Fan battery 2, start fan 4
NO3	KOMP_PARZ3_DO_1_PHY	Capacity step 3 of *compressor* 1
NO4	KOMP_PARZ3_DO_2_PHY	Capacity step 3 of *compressor* 2
NO5	KOMP_PARZ3_DO_3_PHY	Capacity step 3 of *compressor* 3
NO5	KOMP_PARZ3_DO_4_PHY	Capacity step 3 of *compressor* 4
NO7	CIR_INVERSIONE_VALVE_DO_1_PHY	Cycle *reversing valve circuit* 1
NO8	CIR_INVERSIONE_VALVE_DO_2_PHY	Cycle *reversing valve circuit* 2
NO9	CIR_INVERSIONE_VALVE_DO_3_PHY	Cycle *reversing valve circuit* 3
NO10	CIR_INVERSIONE_VALVE_DO_4_PHY	Cycle *reversing valve circuit* 4

9.5 SpotLight

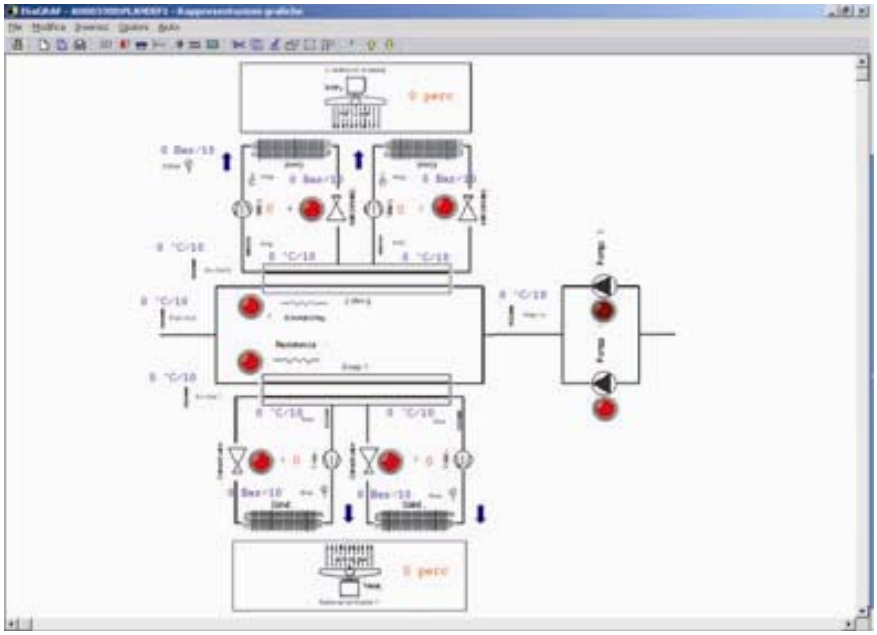
Synoptics PLANDEF and PLANDEF1 can be activated by means of the ISaGRAF SpotLiht function. These only enable the display of:

- Sensor values
- Refrigeration *capacity steps* for each *compressor*
- Status of solenoid valves
- Status of heaters
- Status of primary *circuit* water circulating pumps
- Status of *fans* in the two fan batteries
- Cycle *reversing valve* (BLUE arrows = in *chiller* or *defrost* mode or RED = in *pump* mode)



Picture of PLANDEF *spotlight*: default machine with digital *fans*

Picture of PLANDEF1 *spotlight*: default machine with analogue *fans*



10 USE OF THE DEVICE

10.1 Permitted Use

This unit is used to *control* small, medium and large sized chillers with 1 to 8 compressors and circuits.

For safety purposes, the *control* device must be installed and used in accordance with the instructions supplied. Users must not be able to access parts with dangerous voltage levels under normal operating conditions. The unit must be resistant to water and dust, depending on the specific application, and be accessible only by using special tools. This unit can be fitted on domestic appliances and/or similar units used for air conditioning.
In accordance with the reference standards, this unit is classified:

- as an automatic electronic *control* device to be installed in a standalone configuration or on other units with regard to manufacturing;
- As a Type 1 *control* unit in relation to its manufacturing tolerances and derivatives with regard to its automatic operating characteristics;
- As a Class 2 device with regard to protection against electric shocks (referring to the parts that can be accessed during normal use: front keypad);
- As a Class A device with regard to software class and structure

10.2 Unpermitted Use

The use of the unit for applications other than those described is forbidden.
Please note that the relay contacts supplied are functional and may be subject to failure (since the electronics controlling them may short *circuit* these relays or leave them open). For this reason, any protection devices needed to comply with product requirements or dictated by common sense due to obvious safety reasons should be installed externally.

11 RESPONSIBILITY AND RESIDUAL RISKS

Eliwell Controls s.r.l. shall not be liable for any damages deriving from:

- installation/use other than that prescribed which does not comply with the safety standards specified in the regulations and/or herein;
- use on equipment that does not guarantee adequate protection against electric shock, water or dust when assembled.
- use on equipment that allows dangerous parts to be accessed without the use of tools;
- Installation/use on equipment that is not compliant with the standards and regulations in force.

12 DISCLAIMER

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13 ANALITIC INDEX

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