Energy XT PRO
BaseLine Application [A00053xx]

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:

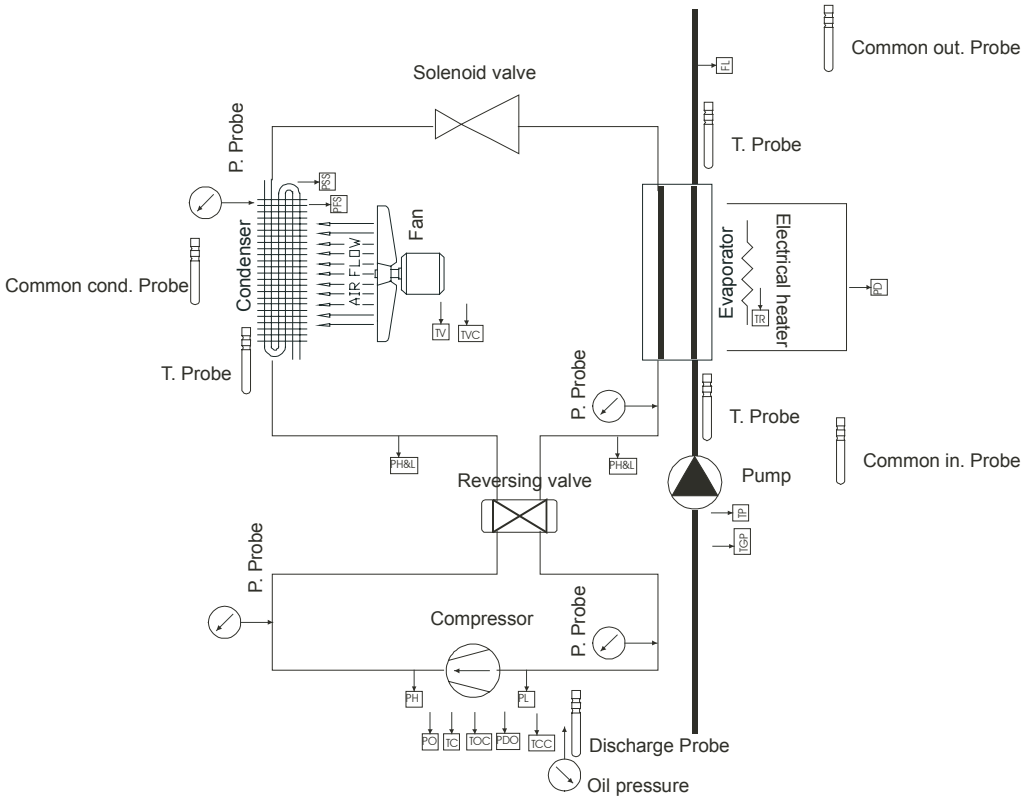
Note: draws attention to a specific topic that users should take into account.

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

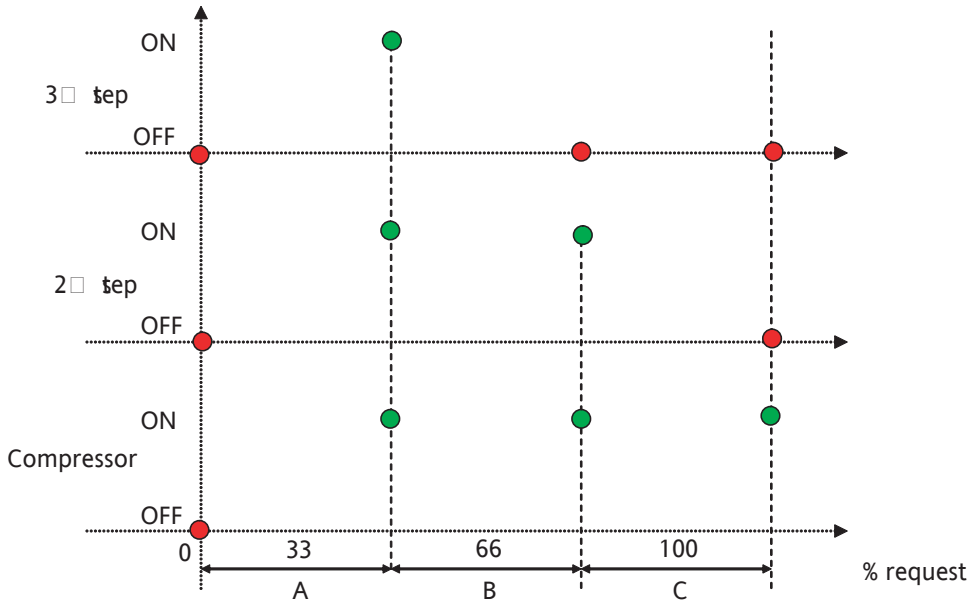
The Base-line chiller is a “water-air” type machine, which contains the following components:



Number of circuits	4	Number of fans per block	4 stepped or 1 continuous
Number of evaporators	2	Number of compressors	4
Number of condensers	4	Number of pumps	2
Number of fan blocks	2	Number of resistors	2

Compressor type

The application can manage up to 4 alternate compressors with 4 *power stages*



3 FUNCTIONS

Depending on parameter TREG_TEMP_SENS, heat regulation may be applied according to the water temperature at the outlet from the thermodynamic system, or the water at the inlet of the thermodynamic system.
The regulation setpoint is also calculated according to the status of parameter (TREG_TEMP_SENS); the following tables show the behaviour and status of the heat regulator according to the setting of the parameter:

Cold Mode

	TREG_TEMP_SENS	
	=ENTRY_SENSOR	**=EXIT_SENSOR**
heat regulation setpoint	CH_ENTRY_OFFSET+ CH_TSET_TEMP+ Dynamic setpoint correction	CH_TSET_TEMP+ Dynamic setpoint correction
Heat regulation sensor	PLAN_TEMP_INWATER_SENS_PHY	PLAN_TEMP_OUTWATER_SENS_PHY

Hot Mode

	TREG_TEMP_SENS	
	=ENTRY_SENSOR	**=EXIT_SENSOR**
heat regulation setpoint	HP_TSET_TEMP- CH_ENTRY_OFFSET+ Dynamic setpoint correction	HP_TSET_TEMP+ Dynamic setpoint correction
Heat regulation sensor	PLAN_TEMP_INWATER_SENS_PHY	PLAN_TEMP_OUTWATER_SENS_PHY

3.1 Types of heat regulation

The type of heat regulation applied can be selected by setting the TREG_FUNCTION parameter.
The Base-Line application allows the uses of two different methods:

- *Proportional heat regulation*
- *PI heat regulation*

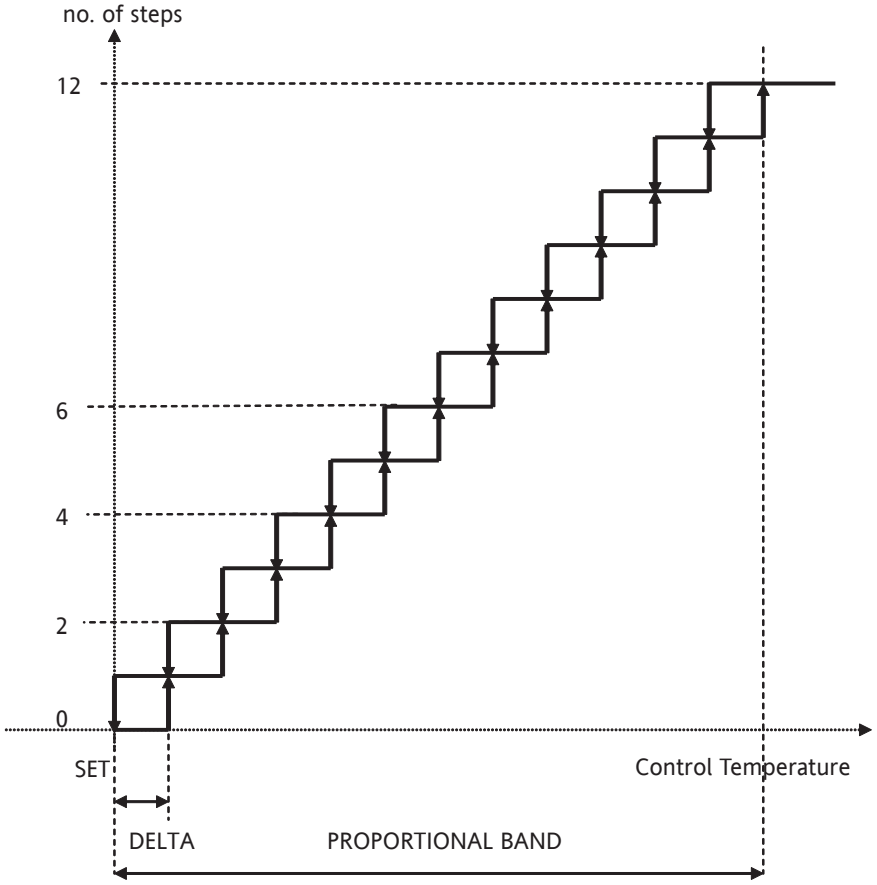
In both cases, the heat regulation function calculates the number of refrigeration resources (power steps) that the system must provide through a resource allocation policy, which can be selected at *evaporator* level (EV_SELECTION_FUNCTION), *circuit* level (CIR_SELECTION_FUNCTION) and *compressor* level (KOMP_SELECTION_FUNCTION).
The time interval for a change in the number of power steps required by the heat regulator 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, the power make-up must always keep to the time intervals described above, particularly the time applied by parameter CH_INC_STEP_TIME/ HP_INC_STEP_TIME

Note: If the value selected for parameter TREG_FUNCTION is TIME_PROPORTIONAL, regulation will be the PROPORTIONAL type.

3.1.1 Proportional heat regulation

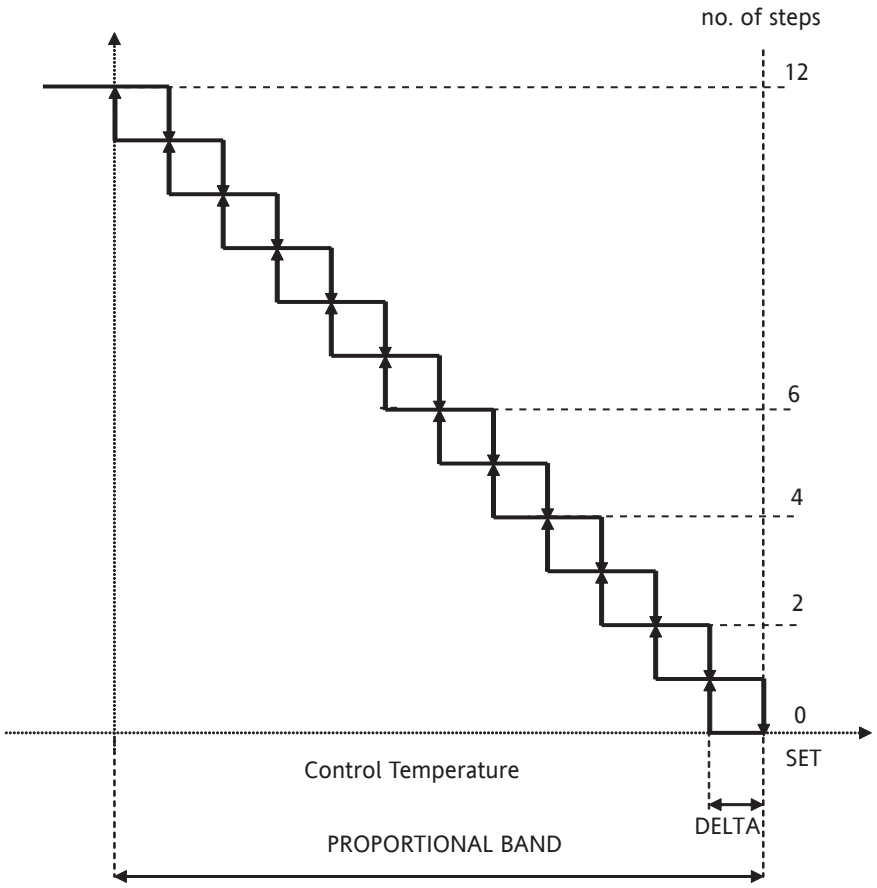
With this type of heat regulation, a specific number of refrigeration resources (power steps) are activated in order to reach the temperature indicated by the setpoint selected for heat regulation. Obviously, the number of power steps in order to reach the heat regulation setpoint is directly proportional to the difference between the temperature measured by the sensor and the temperature 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 table below:

Cold Mode



SET:	Heat regulation setpoint
PROPORTIONAL BAND:	CH_PROP_BAND
DELTA:	CH_PROP_BAND/∑(KOMP_STEP_i +1) (where i=1... number of compressors)
Regulation temperature	Temperature measured by heat regulation sensor
Number of steps	[regulation temperature – SET]/DELTA

Hot Mode



SET:	Heat regulation setpoint
PROPORTIONAL BAND:	HP_PROP_BAND
DELTA:	HP_PROP_BAND/∑(KOMP_STEP_i +1) (where i=1... number of compressors)
Regulation temperature	Temperature measured by heat regulation sensor
Number of steps	[SET-regulation temperature]/DELTA

3.1.2 PI heat regulation

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

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

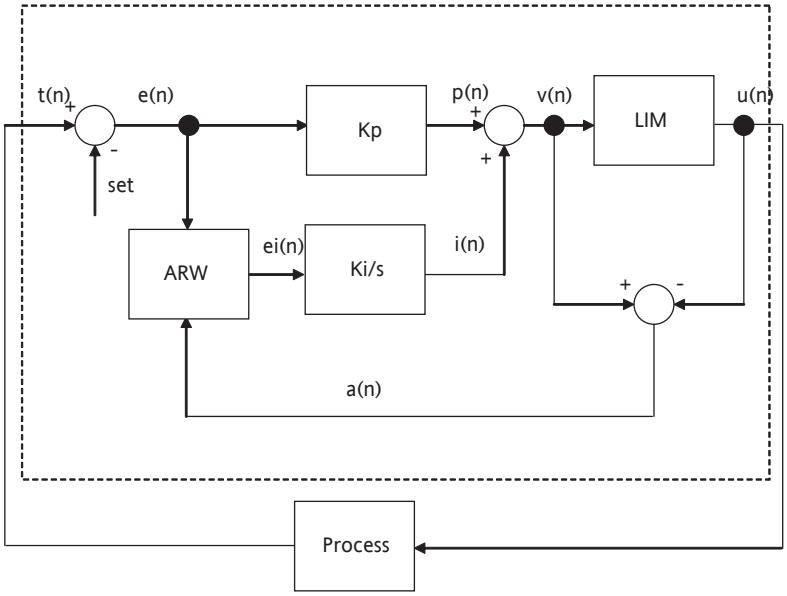
The basic PID controller is characterized by the ideal transfer function from the following:

input e(t) = ***HeatRegulationSetPoint***(t) - ***HeatRegulationSensor*** in Cold Mode or ***HeatRegulationSetPoint*** - ***HeatRegulationSensor***(t) in Hot Mode, i.e. the system error, equal to the difference between the process variable measured (in this case the temperature) and the reference signal (***HeatRegulationSetPoint***)
and the *control* signal u(t) applied to the actuator or directly to the process to be controlled.

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

whether integral component Ki is to be taken into account (PI_INTEGRAL_COMPONENT_FLAG)
whether 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 block diagram below shows the P.I. regulator implemented, with an explanation of the different 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) se 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 uses 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 applied in ISaGRAF
set	Value of ***HeatRegulationSetPoint***
t(n)	regulation water temperature measured by ***HeatRegulationSensor***

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	UM
260	TREG_FUNCTION	Heat regulation type 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 heat regulation	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. heat regulator.	0...1	1	6	H	V	0=NO, 1=YES	flag
263	PI_INTEGRAL_CONSTANT_HOT	Value of Time Integral for the integral component of P.I. heat regulator.	1...900	600	0	H	V		sec
264	PI_PROP_COMPONENT_FLAG_HOT	User flag for proportional component of P.I. heat regulator.	0...1	1	6	H	V	0=NO, 1=YES	flag
270	CH_TSET_TEMP_HOT	Cold setpoint	CH_MIN_TSET_TEMP... CH_MAX_TSET_TEMP	7.0	0	H	V		°C
271	CH_MIN_TSET_TEMP	Minimum value of cold setpoint	-50.0...80.0	5.0	0	C	V		°C
272	CH_MAX_TSET_TEMP	Maximum value of cold setpoint	-50.0...80.0	25.0	0	C	V		°C
273	CH_ENTRY_OFFSET_HOT	Cold setpoint offset if heat regulation is through water inlet temperature sensor of the primary *circuit*	0.0...15.0	0.0	0	H	V		°C
274	CH_PROP_BAND_HOT	Cold proportional band	CH_MIN_PROP_BAND... CH_MAX_PROP_BAND	5.0	0	H	V		°C
275	CH_MIN_PROP_BAND	Minimum value of cold proportional band	0.0...25.0	0.0	0	C	V		°C
276	CH_MAX_PROP_BAND	Maximum value of cold proportional band	0.0...25.0	20.0	0	C	V		°C
277	CH_INC_STEP_TIME_HOT	Time between upward steps (increments in refrigeration power)	0...300	10	0	H	V		sec
278	CH_DEC_STEP_TIME_HOT	Time between downward steps (decrements in refrigeration power)	0...300	10	0	H	V		sec
280	HP_TSET_TEMP_HOT	Hot setpoint	HP_MIN_TSET_TEMP... HP_MAX_TSET_TEMP	40.0	0	H	V		°C
281	HP_MIN_TSET_TEMP	Minimum value of hot setpoint	-50.0...150.0	30.0	0	C	V		°C
282	HP_MAX_TSET_TEMP	Maximum value of hot setpoint	-50.0...150.0	50.0	0	C	V		°C
283	HP_ENTRY_OFFSET_HOT	Offset of hot setpoint if heat regulation is through the water inlet temperature sensor of the primary *circuit*	0.0...15.0	5.0	0	H	V		°C
284	HP_PROP_BAND_HOT	Hot proportional band	HP_MIN_PROP_BAND... HP_MAX_PROP_BAND	5.0	0	H	V		°C
285	HP_MIN_PROP_BAND	Minimum value of hot proportional band	0.0...150.0	5.0	0	C	V		°C
286	HP_MAX_PROP_BAND	Maximum value of hot proportional band	0.0...150.0	5.0	0	C	V		°C
287	HP_INC_STEP_TIME_HOT	Time between upward steps (power increments) in Hot mode	0...300	10	0	H	V		sec
288	HP_DEC_STEP_TIME_HOT	Time between downward steps (power decrements) in Hot mode	0...300	10	0	H	V		sec

3.2 Pump Down

Pump-down is a special start and stop procedure for the *circuit*.
In the stop phase, before the *circuit* goes off, the valve on the gas *circuit* upstream of the *evaporator* (usually called the solenoid valve) is closed, so that the last *compressor* to be started continues to draw gas from the *evaporator* and causes the gas pressure to fall to the pump-down stop value; when it reaches this value, the *compressor* goes off.
This allows the *evaporator* to be kept practically empty during *compressor* stop phases and so prevent any rise in *evaporator* temperature from bringing the minimum pressure up to values that are too high for the *compressor* and the *evaporator*.

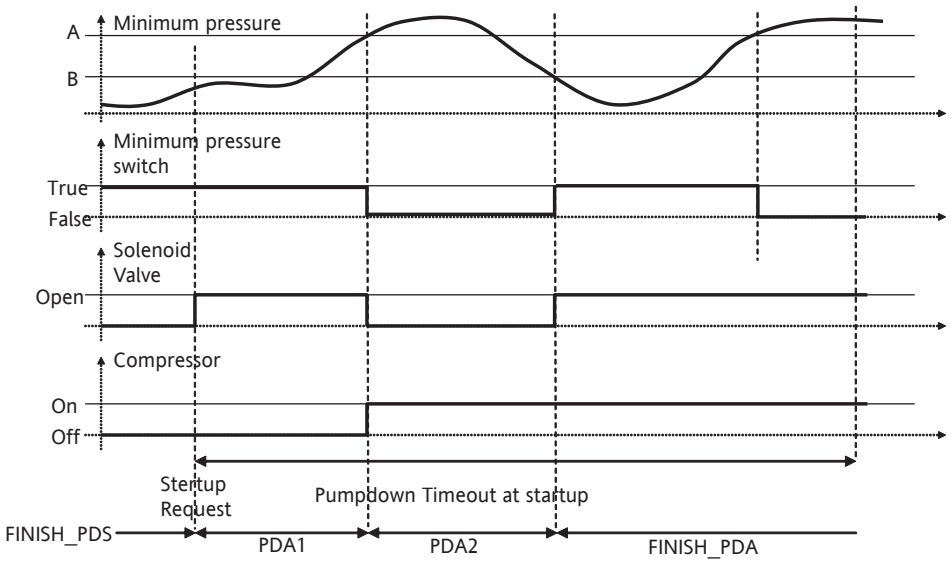
The pump-down procedure is controlled by means of a minimum pressure switch.

3.2.1 Pump-down at start-up

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

- The solenoid valve opens. This causes the pressure in the *circuit* to begin rising [PDA1].
- When the pressure goes above reference value “A”, the solenoid valve closes and the *compressor* starts. With minimum delay, the pressure begins to fall [PDA2].
- When the pressure again reaches (or goes below) reference value “B”, the solenoid valve opens again [FINISH_PDA].

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



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

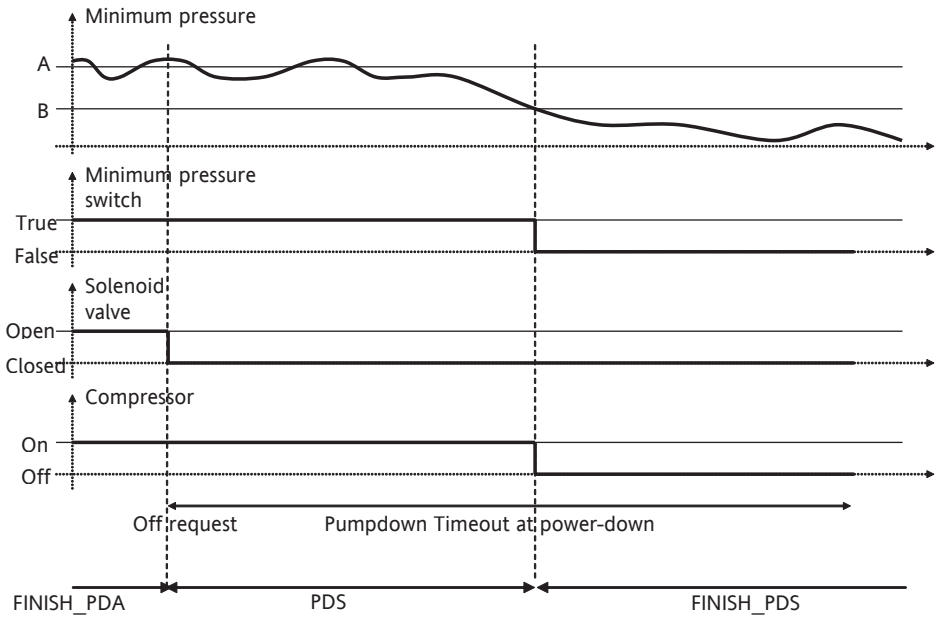
In PDA1 or PDA2, if the *circuit* compressors are not available, the switch goes straight to FINISH_PDS with the *circuit* compressors stopped and the solenoid valve closed.
However, if the *pump-down timeout* of the start-up phase expires in PDA1 or PDA2, the switch goes straight to FINISH_PDA with the compressors controlled by the heat regulator and the solenoid valve open. In this case, only a non-blocking alarm signal is sent. The alarm is reset as soon as a pump-down sequence (start or stop) has been completed correctly. In any case, the alarm is reset when exiting configuration mode and when the system is started/stopped.

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

3.2.2 Pump-down when going down

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

- The solenoid valve closes. This causes the pressure to begin to fall [PDS]
- When the pressure in the *circuit* goes below reference value B, the *compressor* goes off [FINISH_PDS]



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

In PDS, if the *circuit* compressors are not available, or the *pump-down timeout* expires during the going-down phase, the switch goes straight to FINISH_PDS with the *circuit* compressors off and the solenoid valve closed. If the *pump-down timeout* expires during the going-down phase, only a non-blocking alarm signal is sent. The alarm is reset as soon as a pump-down sequence (start or stop) has been completed correctly. In any case, the alarm is reset when exiting configuration mode and when the system is started/stopped

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

3.2.3 Pump-down timeout

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

3.2.4 Solenoid valve control

Solenoid valve	CIR_SOLENOID_VALVE_DO_i_PHY, i=*circuit* number "i".

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

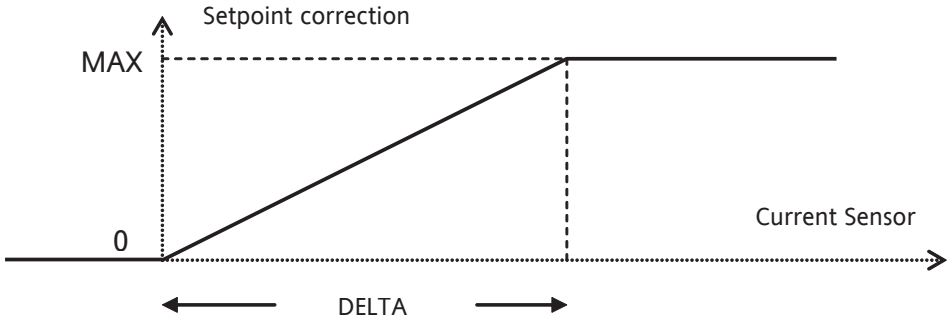
If enabled, the solenoid valve is open only during phases PDA1 and FINISH_PDA for circuits where the pump-down procedure is running. If there is an alarm that blocks the *circuit*, or the compressors belonging to that *circuit* are not available, the solenoid valve is closed, except if there is a minimum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

Note: the solenoid valve is open when the corresponding relay is not energized, and closed when it is energized

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	UM
490	PD_FUNCTION	Selects the pump-down type: not active (NO_PD), at start-up (ON_START), or at start-up and going down (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-up	0...1800	10	0	C	V		sec
492	PD_ONOFF_MAX_TIME	Maximum pump-down time when going down	0...1800	10	0	C	V		sec

3.3 Dynamic setpoint

The *dynamic setpoint* function is used to change the setpoint in automatic mode according to a given input signal at 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 signed correction to the setpoint is added to the current value of the heat regulation setpoint.

If one of the following conditions is present *:*

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

The setpoint correction is always 0.

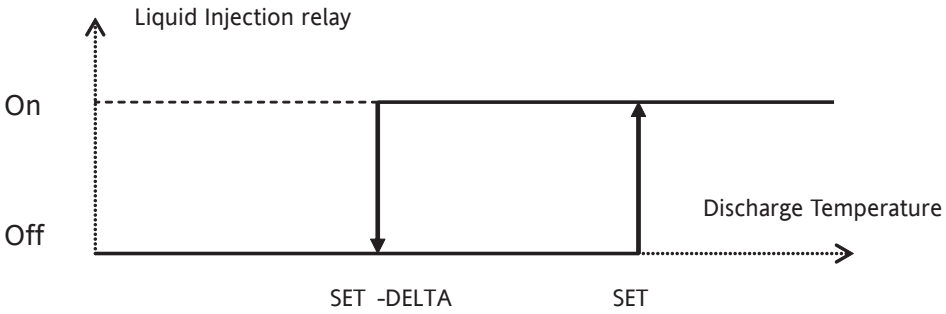
If none of the above conditions are present, the setpoint correction is controlled by the function described in the above diagram.
If parameter DTSET_CHILLER_MAX_OFFSET/ DTSET_HEATPUMP_MAX_OFFSET is set to a negative value, the progression shown in the diagram occurs around the horizontal axis.

Note: current sensor PLAN_CURR_DTSET_SENS_PHY must be configured in the BIOS with the value 4mA set to 0.0 Bar and value 20mA set 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 code conversion	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 of *dynamic setpoint* from cold setpoint	-30.0...30.0	6.0	0	C	V		°C
2A2	DTSET_HEATPUMP_MAX_OFFSET	Maximum offset of *dynamic setpoint* from hot 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*, and performs the liquid injection function.



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

If one of the following conditions is present *:*

- 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 is present, the state of the liquid injection relay is controlled by the hysteresis function described in the diagram above.
In particular, the 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 started or going down;
- exit from configuration mode;
- by a reset;

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	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 Condensation control

In this system, the *fans* are grouped into 2 batteries maximum, which *control* the condensation in the various circuits. Each *circuit* has its own maximum pressure sensor and its own operating dynamics, whereas ventilation is controlled by all circuits belonging to the battery concerned.

To define which circuits belong to which battery, it is necessary to set the CIR_*FANS*_i *parameters*, where i =*circuit* number "i".
For example, in the default machine, the *parameters* are set with the values shown 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 batteries of *fans*, the first for circuits 1 and 2, and the second for circuits 3 and 4.

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

When the system is not Off, the *fans* in the battery are set at maximum/minimum (for chiller/pump) by ventilation requests from each *circuit* in the fan battery (largest of the maximum pressures of each *circuit*). If there is an error in one of the sensors, its value is not taken into account in calculating the maximum/minimum. However, if there is an error in all the sensors, the *fans* are always switched Off unless they are still initializing, i.e. during the time when the *fans* are forced to full power (PANS_CH_INIT_MAX_POWER_TIME/ *FANS*_HP_INIT_MAX_POWER_TIME).

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

A single thermal alarm input is provided per battery, irrespective of the number of *fans* in the battery.
If the thermal protection in a battery is actuated, the *circuit* is immediately blocked.

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

The *fans* can be activated:

- irrespective of the status of the compressors;
- if at least one *compressor* in the *circuit* belonging to the battery is On;

The above can be selected by setting the parameter *FANS*_KOMP_DEPENDENCY_FLAG as required

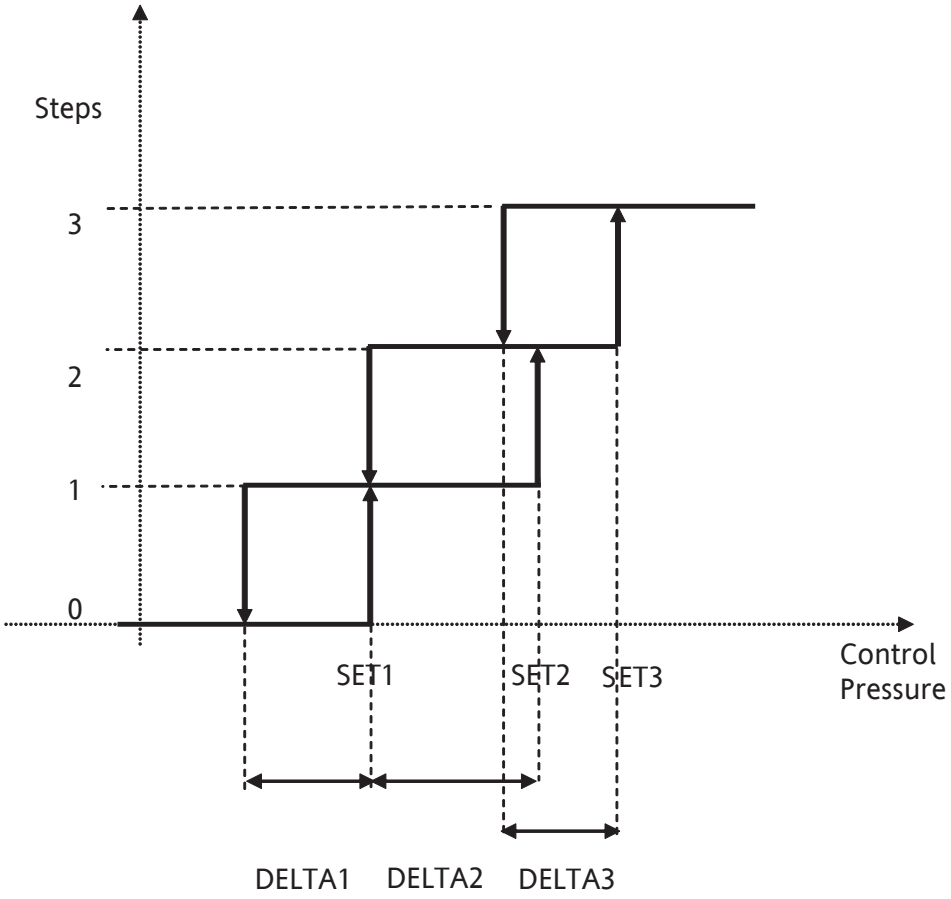
3.5.1 Fan control by steps

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

The time for which the fan battery is forced to maximum power when the first fan of the battery starts can be configured using parameter *FANS*_CH_INIT_MAX_POWER_TIME.

Cold Mode

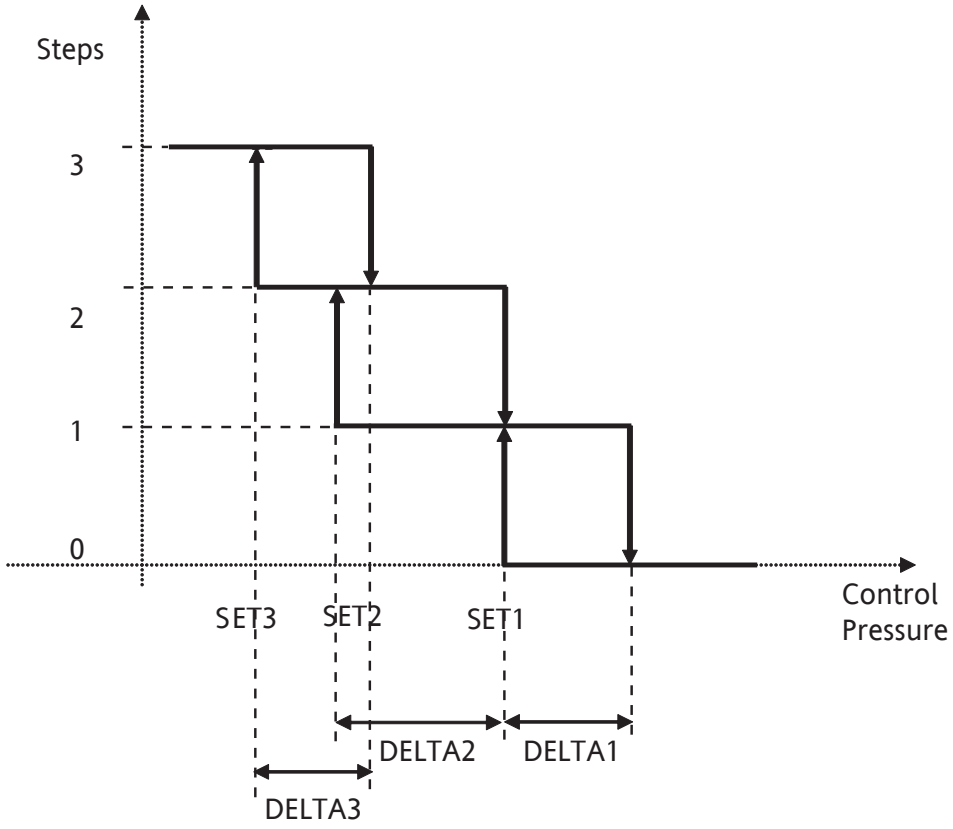
Step number "n" is inserted when the *control* pressure reaches the setpoint configured with parameter *FANS*_CSTART_SETn_PRES
Step number "n" is removed when the *control* pressure reaches the value set in parameter *FANS*_CSTART_SETn_PRES - *FANS*_CSTOP_DELTAn_PRES



SETn	*FANS*_CSTART_SETn_PRES
DELTAn	*FANS*_CSTOP_DELTAn_PRES
Control pressure	MAX(CIR_PRES_MAX_SENS_i_PHY), i = *circuit* number "i" of the battery
Steps	*FANS*_ACCj_DO_i_PHY, j=fan number "j" of battery number "i" i=battery number "i".

Hot Mode

Step number "n" is inserted when the *control* pressure is equal to or below the setpoint configured with parameter *FANS*_HSTART_SETn_PRES.
Step number "n" is switched off when the *control* pressure reaches the value defined by *FANS*_HSTART_SETn_PRES + *FANS*_HSTOP_DELTAn_PRES



SETn	*FANS*_HSTART_SETn_PRES
DELTAn	*FANS*_HSTOP_DELTAn_PRES
Control pressure	MIN(CIR_PRES_MAX_SENS_i_PHY), i = *circuit* number "i" of the battery
Steps	*FANS*_ACCj_DO_i_PHY, j=fan number "j" of battery number "i" i=battery number "i".

Note: If there is an error in all the maximum pressure sensors of the circuits belonging to a battery, all the *fans* in the battery concerned are stopped.

3.5.1.1 Fans with the same/different power output

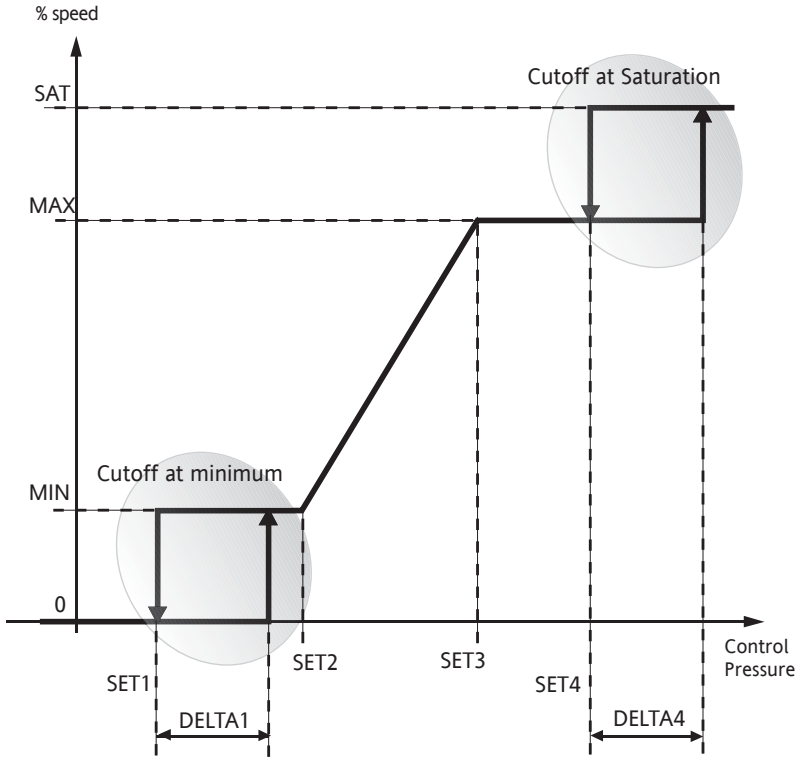
If the *fans* belonging to one condenser are all the same, the steps are inserted continuously (if 3 steps are requested, 3 *fans* are active).
If the *fans* have different power outputs (this option is configured with parameter *FANS*_ASYMMETRICAL_FLAG), the *fans* are activated alternately (when fan 3 is On, fan 2 is Off).

3.5.2 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 *FANS*_NO_i *parameters* (where i=fan battery "i") are not taken into account as each fan battery is automatically associated with its own unique analog output.

Cold Mode

Below is shown how the ventilation behaves in chiller mode when the initialization time and Cutoff bypass time are zero and parameter CUTOFF_CH_ENABLED_FLAG is set to YES. See also the section on Minimum Ventilation Starting Time



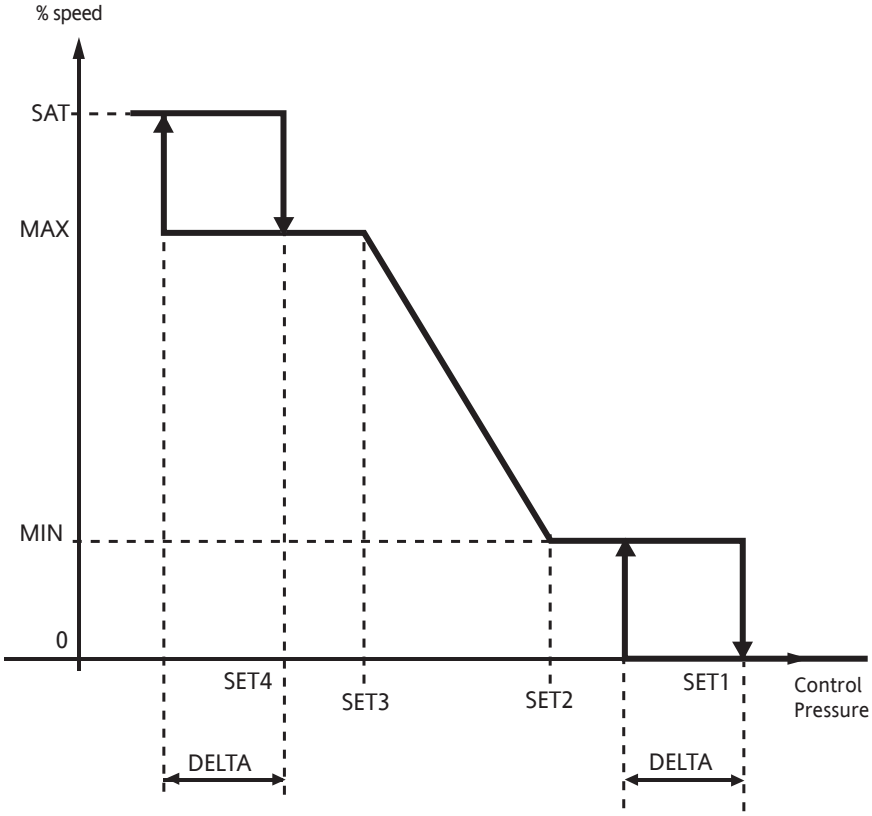
SET1	CUTOFF_CH_SETPOINT1_PRES
DELTA1	CUTOFF_CH_DELTA1_PRES
SET2	*FANS*_CH_START_PRES
SET3	*FANS*_CH_SATURATION_PRES
SET4	CUTOFF_CH_SETPOINT2_PRES
DELTA4	CUTOFF_CH_DELTA2_PRES
SAT	*FANS*_CH_SAT_SPEED
MIN	*FANS*_CH_MIN_SPEED
MAX	*FANS*_CH_MAX_SPEED
Control pressure	MAX(CIR_PRES_MAX_SENS_i_PHY), i = *circuit* number "i" of the fan battery (the sensors with errors are not taken into account for the maximum calculation)
Speed *:*	*FANS*_CTRL_AO_j_PHY, % speed of fan battery number "j".

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

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

Hot Mode

Below is shown how the heat pump ventilation behaves when the initialization time and Cutoff bypass time are zero and parameter CUTOFF_CH_ENABLED_FLAG is set to YES.
Refer to the section on Ventilation Minimum Startup Time



SET1	CUTOFF_HP_SETPOINT1_PRES
DELTA	CUTOFF_HP_DELTA1_PRES
SET2	*FANS*_HP_START_PRES
SET3	*FANS*_HP_SATURATION_PRES
SET4	CUTOFF_HP_SETPOINT2_PRES
DELTA4	CUTOFF_HP_DELTA2_PRES
SAT	*FANS*_HP_SAT_SPEED
MAX	*FANS*_HP_MAX_SPEED
MIN	*FANS*_HP_MIN_SPEED
Control pressure	MAX(CIR_PRES_MAX_SENS_i_PHY), i = *circuit* number "i" of the fan battery (the sensors with errors are not taken into account for the maximum calculation)
Speed *:*	*FANS*_CTRL_AO_j_PHY, % speed of fan battery number "j".

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

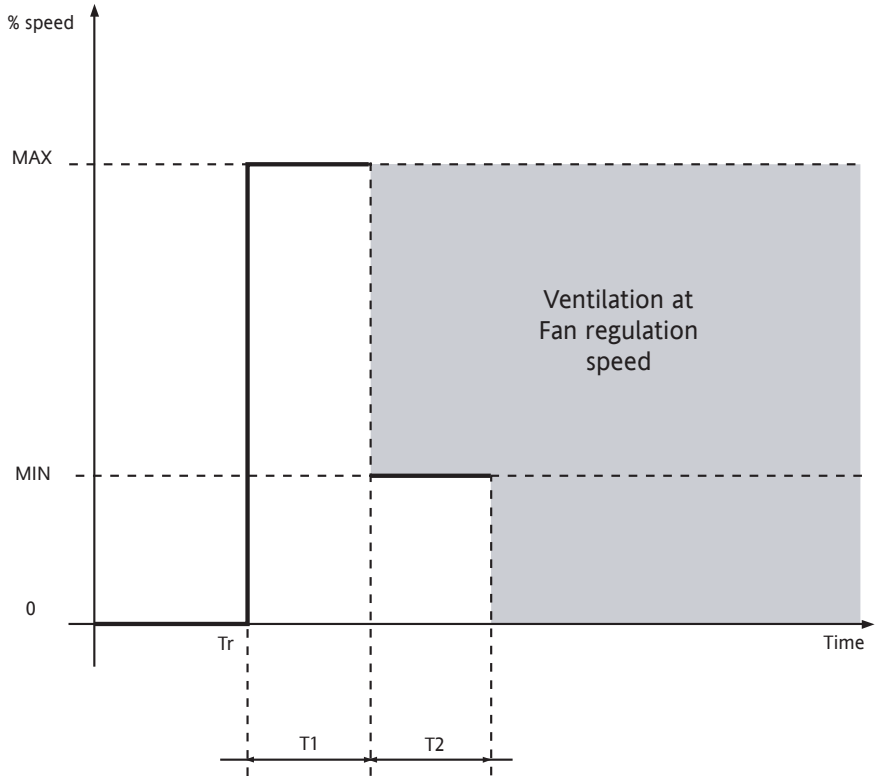
- cutoff at minimum: the fan speed changes from 0 to MIN when the *control* pressure reaches SET2 “from above”. If the *control* pressure reaches SET2 “from below”, the speed changes from MIN to 0.
- saturation cutoff: when the *control* pressure reaches SET3 “from below”, fan speed is at MAX. If the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

Note that if the time during which *fans* are forced to full power (*FANS*_CH_INIT_MAX_POWER_TIME/*FANS*_HP_INIT_MAX_POWER_TIME) is still running, 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 of the circuits belonging to a battery, all the *fans* in the battery concerned are stopped.

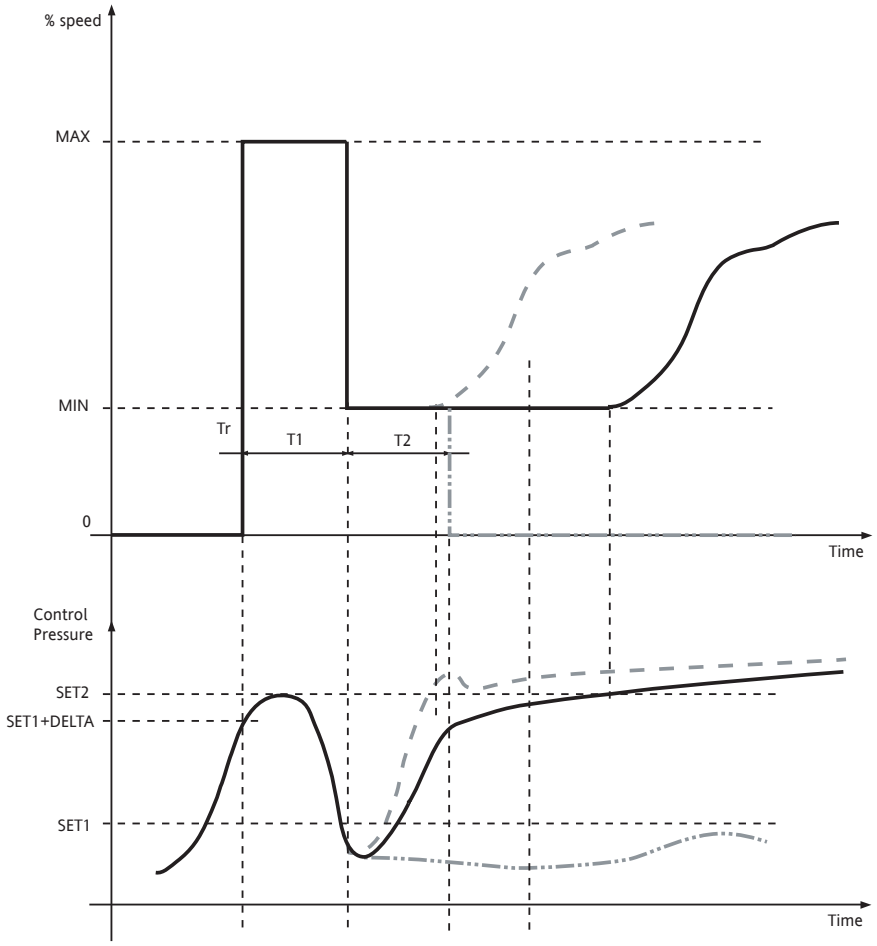
3.5.2.2 Ventilation minimum On time

After initialization, for the time set 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 regulator. The *fans* are also stopped if there is a fan blocking alarm.
The following diagram illustrates the above



Tr	Moment at which 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 diagram shows the effect of initialization and minimum On time on the fan speed following a ventilation on request. For the sake of simplicity, the example is related to chiller mode only:



Tr	Moment at which ventilation is requested
T1	*FANS*_CH_INIT_MAX_POWER_TIME
T2	CUTOFF_CH_BYPASS_TIME
MAX	*FANS*_CH_MAX_SPEED o *FANS*_CH_SAT_SPEED
MIN	*FANS*_CH_MIN_SPEED
SET1	CUTOFF_CH_SETPOINT_PRES
DELTA	CUTOFF_CH_DELTA_PRES
SET2	*FANS*_CH_START_PRES

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

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of code conversion	UM
208	CIR_*FANS*_1	Associate *circuit* 1 with the fan group indicated	1...2	1	0	C	V		num
209	CIR_*FANS*_2	Associate *circuit* 2 with the fan group indicated	0...2	1	0	C	V		num
20A	CIR_*FANS*_3	Associate *circuit* 3 with the fan group indicated	0...2	2	0	C	V		num
20B	CIR_*FANS*_4	Associate *circuit* 4 with the fan group indicated	0...2	2	0	C	V		num
20C	CIR_*FANS*_5	Associate *circuit* 5 with the fan group indicated	0...2	0	0	C	V		num
20D	CIR_*FANS*_6	Associate *circuit* 6 with the fan group indicated	0...2	0	0	C	V		num
20E	CIR_*FANS*_7	Associate *circuit* 7 with the fan group indicated	0...2	0	0	C	V		num
20F	CIR_*FANS*_8	Associate *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 output (YES). Changes the order of activation / deactivation of the fan relays	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 set to NO, the *fans* in the batteries operate independently of the status of the compressors belonging to the circuits in which the batteries are controlling the condensation, otherwise at least one of these compressors must be On so that fan *control* can be actuated for the batteries.	0...1	1	6	C	V	0=NO, 1=YES	flag
341	*FANS*_CH_INIT_MAX_POWER_TIME	Time during which the *fans* in the batteries are operating at full power each time the battery is started	0...120	60	0	C	V		sec
342	*FANS*_HP_INIT_MAX_POWER_TIME	Time during which the *fans* in the batteries are operating at full power each time the battery is started in Hot mode	0...120	60	0	C	V		sec
343	*FANS_CONTROL*_FUNCTION	Selects the type of fan *control* and actuation	0...1	0	31	C	V	0=CONT, 1=DIGITAL	flag
344	CUTOFF_CH_ENABLED_FLAG	Enable CUTOFF for chiller	0...1	1	6	C	V	0=NO, 1=YES	flag
345	CUTOFF_HP_ENABLED_FLAG	Enable CUTOFF for heat pump	0...1	1	6	C	V	0=NO, 1=YES	flag
360	*FANS*_CSTART_SET1_PRES	Setpoint for activating ventilation step 1	0.0...50.0	13.0	0	C	V		Bar
361	*FANS*_CSTART_SET2_PRES	Setpoint for activating ventilation step 2	0.0...50.0	15.0	0	C	V		Bar
362	*FANS*_CSTART_SET3_PRES	Setpoint for activating ventilation step 3	0.0...50.0	17.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of code conversion	UM
363	*FANS*_CSTART_SET4_PRES	Setpoint for activating ventilation step 4	0.0...50.0	19.0	0	C	V		Bar
364	*FANS*_CSTART_SET5_PRES	Setpoint for activating ventilation step 5	0.0...50.0	0.0	0	C	V		Bar
365	*FANS*_CSTART_SET6_PRES	Setpoint for activating ventilation step 6	0.0...50.0	0.0	0	C	V		Bar
366	*FANS*_CSTART_SET7_PRES	Setpoint for activating ventilation step 7	0.0...50.0	0.0	0	C	V		Bar
367	*FANS*_CSTART_SET8_PRES	Setpoint for activating ventilation step 8	0.0...50.0	0.0	0	C	V		Bar
368	*FANS*_CSTOP_DELTA1_PRES	Delta for deactivation of ventilation step 1	0.0...10.0	2.0	0	C	V		Bar
369	*FANS*_CSTOP_DELTA2_PRES	Delta for deactivation of ventilation step 2	0.0...10.0	2.0	0	C	V		Bar
36A	*FANS*_CSTOP_DELTA3_PRES	Delta for deactivation of ventilation step 3	0.0...10.0	2.0	0	C	V		Bar
36B	*FANS*_CSTOP_DELTA4_PRES	Delta for deactivation of ventilation step 4	0.0...10.0	2.0	0	C	V		Bar
36C	*FANS*_CSTOP_DELTA5_PRES	Delta for deactivation of ventilation step 5	0.0...10.0	0.0	0	C	V		Bar
36D	*FANS*_CSTOP_DELTA6_PRES	Delta for deactivation of ventilation step 6	0.0...10.0	0.0	0	C	V		Bar
36E	*FANS*_CSTOP_DELTA7_PRES	Delta for deactivation of ventilation step 7	0.0...10.0	0.0	0	C	V		Bar
36F	*FANS*_CSTOP_DELTA8_PRES	Delta for deactivation of ventilation step 8	0.0...10.0	0.0	0	C	V		Bar
3A0	*FANS*_CH_MIN_ON_TIME	Minimum On time for ventilation in chiller mode at minimum speed at least	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 a CUTOFF_CH_SETPOINT1_PRES. If the pressure value goes above the 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 is expressed as a percentage, and 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 up 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 the minimum fan speed in chiller mode	0...100	20	0	C	V		%
3A6	*FANS*_CH_MAX_SPEED	Percentage value of the maximum fan speed in chiller mode at end of gradient.	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 goes above 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 the maximum fan speed in chiller mode	0...100	90	0	C	V		%
3C0	*FANS*_HSTART_SET1_PRES	Setpoint for activating ventilation step 1	0.0...50.0	12.0	0	C	V		Bar
3C1	*FANS*_HSTART_SET2_PRES	Setpoint for activating ventilation step 2	0.0...50.0	10.0	0	C	V		Bar
3C2	*FANS*_HSTART_SET3_PRES	Setpoint for activating ventilation step 3	0.0...50.0	8.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of code conversion	UM
3C3	*FANS*_HSTART_SET4_PRES	Setpoint for activating ventilation step 4	0.0...50.0	6.0	0	C	V		Bar
3C4	*FANS*_HSTART_SET5_PRES	Setpoint for activating ventilation step 5	0.0...50.0	0.0	0	C	V		Bar
3C5	*FANS*_HSTART_SET6_PRES	Setpoint for activating ventilation step 6	0.0...50.0	0.0	0	C	V		Bar
3C6	*FANS*_HSTART_SET7_PRES	Setpoint for activating ventilation step 7	0.0...50.0	0.0	0	C	V		Bar
3C7	*FANS*_HSTART_SET8_PRES	Setpoint for activating ventilation step 8	0.0...50.0	0.0	0	C	V		Bar
3C8	*FANS*_HSTOP_DELTA1_PRES	Delta for deactivation of ventilation step 1	0.0...10.0	2.0	0	C	V		Bar
3C9	*FANS*_HSTOP_DELTA2_PRES	Delta for deactivation of ventilation step 2	0.0...10.0	2.0	0	C	V		Bar
3CA	*FANS*_HSTOP_DELTA3_PRES	Delta for deactivation of ventilation step 3	0.0...10.0	2.0	0	C	V		Bar
3CB	*FANS*_HSTOP_DELTA4_PRES	Delta for deactivation of ventilation step 4	0.0...10.0	2.0	0	C	V		Bar
3CC	*FANS*_HSTOP_DELTA5_PRES	Delta for deactivation of ventilation step 5	0.0...10.0	0.0	0	C	V		Bar
3CD	*FANS*_HSTOP_DELTA6_PRES	Delta for deactivation of ventilation step 6	0.0...10.0	0.0	0	C	V		Bar
3CE	*FANS*_HSTOP_DELTA7_PRES	Delta for deactivation of ventilation step 7	0.0...10.0	0.0	0	C	V		Bar
3CF	*FANS*_HSTOP_DELTA8_PRES	Delta for deactivation of ventilation step 8	0.0...10.0	0.0	0	C	V		Bar
400	*FANS*_HP_MIN_ON_TIME	Minimum On time for ventilation in free cooling at minimum speed at least	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_SETPOINT_PRES. If the ventilation *control* pressure goes below the difference, the ON/OFF *control* (due to CUTOFF) becomes 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 is expressed as a percentage, and 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 up 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	Minimum fan speed in pump mode, expressed as a percentage	0...100	40	0	C	V		%
406	*FANS*_HP_MAX_SPEED	Maximum fan speed in pump mode, expressed as a percentage	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	Maximum fan speed in pump mode, expressed as a percentage.	0...100	90	0	C	V		%

3.6 Hydraulic pumps control

The system allows the pumps in the pump group to be controlled individually, to ensure circulation of the intermediate fluid (the controller starts/stops the individual pumps).
The number of pumps managed is the number defined with the PUMPS_NO parameter; in this case, it is set to 2

3.6.1 Hours of pump usage

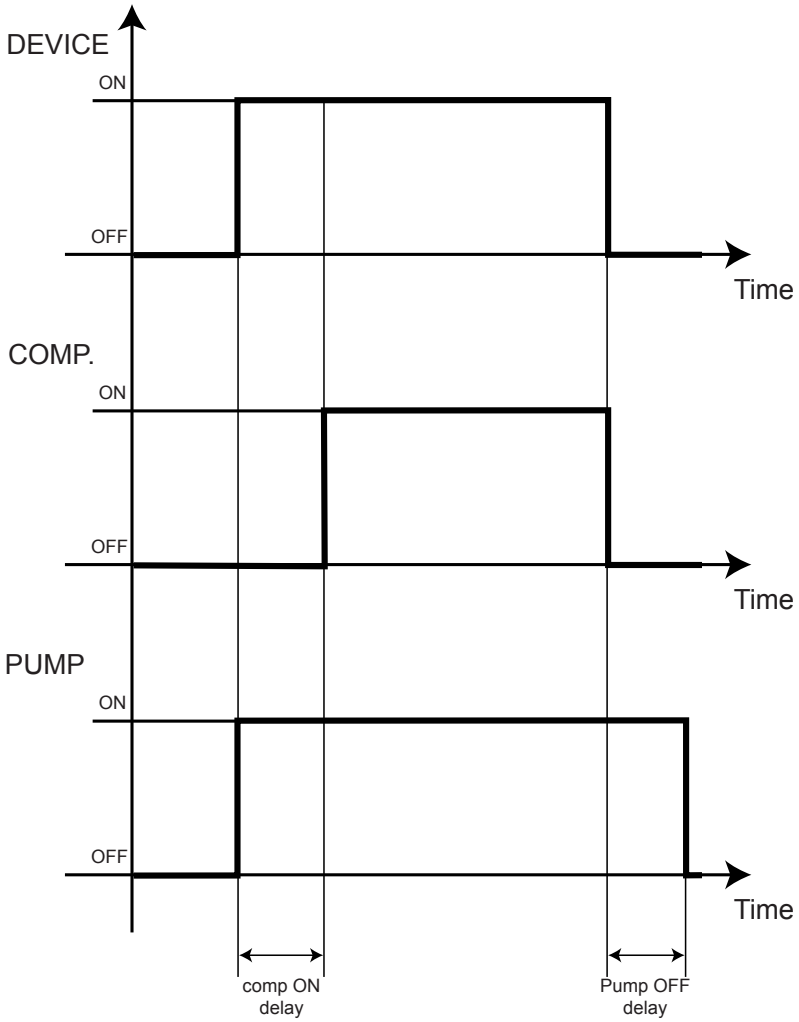
The operating time of the pumps is stored every hour in EEPROM, in the two following *parameters :*

- PUMP_USAGE_DAYS_i, : days of use of pump number "i"
- PUMP_USAGE_HOUR_i, : hours of use of pump number "i"

3.6.2 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 at delay time (PUMPGROUP_STARTUP_DELAY_TIME) after the pump is started



- The pump is stopped at delay time (PUMPGROUP_STOP_DELAY_YIME) after the last *compressor* is switched off.

STRUM.	Device status
COMPR.	*Compressor* status
PUMP	Pump statuses
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, in cases where activation of the *antifreeze* resistors has been requested. (See paragraph on

3.6.2.1 Swap timer

While a pump is in operation, a counter counts the running time (set by parameter PUMPS_ALTERNATION_TIME), at the end of which the active pump is stopped and the second pump is activated.
If the second pump is not available when the alternation time has elapsed, 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 code conversion	UM
222	PUMPS_NO	Number of pumps in the system	1...2	2	0	C	V		num
463	PUMPS_ALTERNATION_TIME	Associate *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 causes activation of the selected pump) and the start of heat regulation	0...2000	60	0	C	V		sec
465	PUMPGROUP_STOP_DELAY_TIME	Time for which the active pump must remain On after there has been a system Off request and the last *compressor* goes 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

3.7 Selection of refrigeration resources

3.7.1 Availability

For each component level 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.
Each time there is an alarm in a subsystem, the minimum and maximum availabilities are reset.
If a subsystem is counting safety protection times, the maximum and minimum availabilities are blocked and retain the value of their power output at the time they are blocked.

Example
If we have a *circuit* that has 2 compressors with 3 *power stages* (i.e. 0,1,2,3,4), and we indicate in square brackets the minimum and maximum *availability* and accessibility of a component, we have a situation where *:*

- a *circuit* with an alarm, with *availability* [0,0] and accessibility time [0,0].
- an Off *circuit*, where the compressors cannot be started due to safety protection times, with *availability* [0,0] and accessibility [0, 8]
- a *circuit* where one *compressor* is On and blocked at level 2 and the other is disabled, where *circuit availability* is [2,2] and accessibility is [0,4].

3.7.2 Control

For each component level of the system (*evaporator*, *circuit*, *compressor*) parameter (EV_SELECTION_FUNCTION, CIR_SELECTION_FUNCTION, KOMP_SELECTION_FUNCTION) can be used to set the selection policy applied by the heat regulator for distributing refrigeration resources: the policies available are Saturation and Balancing.

The selection policies are based mainly on the hours of operation of the compressors.
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 hermetically and semi-hermetically sealed compressors, the minimum unit of refrigeration power now managed by heat regulators, usually called a “step”, corresponds to one power stage of the *compressor* in the case of modulated compressors, or to the *compressor* itself if is not modulated.

The selection policies are applied in cascade to the system components. When there is a request from the heat regulator to activate/deactivate a step, the request is assigned to the best *evaporator* (according to the *evaporator* selection policy configured with the EV_SELECTION_FUNCTION parameter), and then to the best *evaporator circuit* (according to the selection policy configured with the CIR_SELECTION_FUNCTION parameter), and finally to the best *compressor* on the *circuit* (according to the *compressor selection* policy configured with the KOMP_SELECTION_FUNCTION parameter)

3.7.3 Balancing characteristics

The **balancing** (irrespective of the component to which it is applied) is subject to the following rules*:*

1. staticity: if the current assignments of refrigeration resources meet the current request, 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 at points 3) and 4);

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

4. when there is a request to decrement by one step, the components that can be decremented are taken into consideration, and the one at the largest distance from its minimum *availability* value is selected'. If there are more than one 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.

3.7.4 Compressor

A *compressor* is said to be *saturated* if it is at its maximum power output (maximum number of power steps that can be supplied). For compressors with *power stages*, the current activation level of the *compressor* is defined as the number of steps being supplied by the *compressor* at the time (for example, a *compressor* with 3 stages will have a maximum of 4 activation levels/steps).
For compressors located within the same *circuit*, the activation requirements (increments/decrements) are as follows.

3.7.4.1 Compressor saturation

The saturation policy attempts to distribute resources to the smallest possible number of compressors that is compatible with the constraints imposed by the other requirements, for example: protection times for compressors, maximum number of start-ups within one hour. The resulting allocation is intended to have the largest possible number of compressors switched off at any one time.

3.7.4.2 Compressor balancing

The balancing policy attempts to distribute resources equally over the largest possible number of compressors that is compatible with the constraints imposed by the other requirements, for example safety protection times, maximum number of start-ups within one hour. The resulting allocation is intended to have the greatest possible equalization of power output levels in the compressors at any one time.

3.7.5 Circuit

A *circuit* is said to be saturated when it is at its maximum power output (sum of the maximum numbers of power steps that can be supplied by the compressors belonging to the *circuit*). A *circuit* is said to be active or On if at least one *compressor* is activated at one step; it is said to be Off if none of the compressors are activated. The current activation level of a particular *circuit* is defined as the total number of power steps that the compressors are supplying at the time (for example, a *circuit* that has 2 compressors with 3 *power stages* can supply up to 8 activation levels/steps).
For circuits located within the same *evaporator*, the requirements for activation levels are as follows.

3.7.5.3 Circuit saturation

The saturation policy attempts to distribute resources equally over the smallest possible number of circuits that is compatible with the constraints imposed by the other requirements, for example safety protection times, maximum number of start-ups within one hour. The resulting allocation is intended to have the largest possible number of circuits deactivated at any one time.

3.7.5.4 Circuit balancing

The balancing policy attempts to distribute resources equally over the largest possible number of circuits that is compatible with the constraints imposed by the other requirements, for example safety protection times, maximum number of start-ups within one hour. The resulting allocation is intended to have *circuit* power output levels equalized as much as possible at any one time.

3.7.6 Evaporator

An *evaporator* is said to be saturated when it is at its maximum power output (total of the maximum numbers of power steps that can be supplied by the circuits belonging to the *evaporator*). An *evaporator* is said to be active or On if at least one *circuit* is activated; it is said to be Off if none of the circuits is activated. The current activation level of an *evaporator* is defined as the total number of power steps that the circuits are supplying at the time (for example, an *evaporator* that has 2 circuits, and 2 compressors with 3 *power stages* per *circuit*, can supply up to 16 activation levels/steps). For evaporators located within the same system, the requirements for activation levels are as follows.

3.7.6.5 Evaporator saturation

The saturation policy attempts to distribute resources to the smallest possible number of evaporators that is compatible with the constraints imposed by the other requirements, for example: protection times for compressors, maximum number of start-ups within one hour. The resulting allocation is intended to have the largest number of evaporators deactivated at any one time.

3.7.6.6 Evaporator balancing

The balancing policy attempts to distribute resources equally over the largest possible number of evaporators that is compatible with the constraints imposed by the other requirements, for example safety protection times, maximum number of start-ups within one hour. The resulting allocation is intended to have *circuit* power output levels equalized 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 code conversion	UM
240	EV_SELECTION_FUNCTION	Sets the selection policy for refrigeration power resources at *evaporator* level	0...1	1	28	C	V	0=SATURATION, 1=BALANCING	flag
241	CIR_SELECTION_FUNCTION	Sets the selection policy for refrigeration power resources at *circuit* level	0...1	1	29	C	V	0=SATURATION, 1=BALANCING	flag
242	KOMP_SELECTION_FUNCTION	Sets the selection policy for refrigeration power resources at *compressor* level	0...1	0	30	C	V	0=SATURATION, 1=BALANCING	flag

3.8 Compressor management

3.8.1 Compressor configuration

The compressors are configured by setting parameter KOMP_CIRC_EV_i to associate *compressor* number "i" with *:*

- the *circuit* that corresponds to the unit value of parameter KOMP_CIRC_EV_i;
- the *evaporator* that corresponds 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 represents 4 compressors in all; 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 in strictly ascending order.

3.8.2 Compressor timing

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

The On and Off times of a *compressor* must meet the following requirements*:*

- Safety protection time for power decrement stages (parameter CPWR_UPDOWN_MIN_TIME). This is the minimum time that must elapse between the different stages being switched off on the same *compressor*.
- Safety protection time for power increment stages (parameter CPWR_DOWNUP_MIN_TIME). This is the minimum time that must elapse between *power stages* being started on the same *compressor*.

Times between *compressor* start-ups must meet the following requirement*:*

- Minimum time between *compressor* start-ups (parameter SOFTSTART_TIME). This is to ensure that the electrical power line is not subjected to simultaneous start-ups of more than one compressors

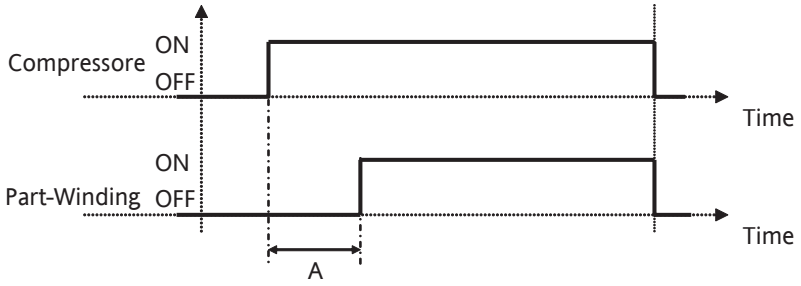
3.8.3 Hours of use of compressors

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

- KOMP_USAGE_DAYS_i, days of use of *compressor* number "i"
- KOMP_USAGE_HOUR_i, hours of use of *compressor* number "i"

3.8.4 Part-winding start-up

Each *compressor* is associated with a relay, which is used to limit current peaks when the *compressor* is started. Its function is described in the Figure



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

3.8.5 Power stages

A system with power modulated compressors is configured with *parameters* KOMP_STAGE_i, i=*compressor* number "i". If KOMP_STAGE_i =0, the system does not manage modulated compressors. Otherwise, parameter KOMP_STAGE_i must be set with the *power stages* of each *compressor* (where "i" = the *compressor* number).
Parameter KOMP_TYPE defines the actuation mode for the *power stages*

Parameter	Explanation
KOMP_STAGE_i	Selects the number of power divisions in *compressor* number "i"
KOMP_TYPE	Power stage actuation mode: SEMI-HERMETIC SCREW

KOMP_STAGE_i=0

There are no *power stages*, i.e. the *compressor* supplies either 0% or 100% of its power.

KOMP_STAGE_i=1 (2 heat regulation steps)

There is 1 power stage, i.e. the *compressor* can supply 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 heat regulation steps)

There are 2 *power stages*, i.e. the *compressor* can supply 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 heat regulation steps)

There are 3 *power stages*, i.e. the *compressor* can supply 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=*compressor* number "i"

PARZ1	KOMP_PARZ1_DO_i_PHY, i=*compressor* number "i"
PARZ2	KOMP_PARZ2_DO_i_PHY, i=*compressor* number "i"
PARZ3	KOMP_PARZ3_DO_i_PHY, i=*compressor* number "i"

3.8.6 Compressor selection

Compressors can be de-selected individually using the *parameters* KOMP_SELEZ_i_HOT, where i=*compressor* number "i".
De-selecting a *compressor* means*:*

- the *compressor availability* is set to zero
- all the *compressor*'s alarms are set to zero.
- its alarms are not managed

3.8.7 Maximum number of start-ups 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 start-ups in the last hour reaches the maximum value, the *availability* of this *compressor* is set to zero.
The number of start-ups is stored with a time resolution of 3600/32 seconds.
The *compressor* will become available again only when the number of starts stored over the past hour falls below MAX_STARTS_PER_HOUR_NO. This can be known with certainty only when the last start-up took place more than one hour previously.
The number of start-ups is always set to zero *:*

- by changing from On to Off (using the keypad or the 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 code conversion	UM
200	KOMP_CIR_EV_1	Associate *compressor* 1 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	11...24	11	0	C	V		num
201	KOMP_CIR_EV_2	Associate *compressor* 2 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	12	0	C	V		num
202	KOMP_CIR_EV_3	Associate *compressor* 3 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	21	0	C	V		num
203	KOMP_CIR_EV_4	Associate *compressor* 4 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	22	0	C	V		num
204	KOMP_CIR_EV_5	Associate *compressor* 5 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
205	KOMP_CIR_EV_6	Associate *compressor* 6 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
206	KOMP_CIR_EV_7	Associate *compressor* 7 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
207	KOMP_CIR_EV_8	Associate *compressor* 8 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
210	KOMP_STAGE_1	Number of *power stages* of *compressor* 1	0...3	2	0	C	V		num
211	KOMP_STAGE_2	Number of *power stages* of *compressor* 2	0...3	2	0	C	V		num
212	KOMP_STAGE_3	Number of *power stages* of *compressor* 3	0...3	2	0	C	V		num
213	KOMP_STAGE_4	Number of *power stages* of *compressor* 4	0...3	2	0	C	V		num
214	KOMP_STAGE_5	Number of *power stages* of *compressor* 5	0...3	2	0	C	V		num
215	KOMP_STAGE_6	Number of *power stages* of *compressor* 6	0...3	2	0	C	V		num
216	KOMP_STAGE_7	Number of *power stages* of *compressor* 7	0...3	2	0	C	V		num
217	KOMP_STAGE_8	Number of *power stages* of *compressor* 8	0...3	2	0	C	V		num
218	KOMP_TYPE	*Compressor type*. Affects the way in which the activation/deactivation sequence is applied to the relays associated with the *power stages* of the compressors	0...1	0	12	C	V	0=SEMI-HERMETIC, 1=SCREW	num
2F0	MIN_OFFON_TIME_HOT	Safety protection time from *compressor* OFF to ON	0...500	60	0	H	V		sec
2F1	MIN_ONOFF_TIME_HOT	Safety protection time from *compressor* ON to OFF	0...500	10	0	H	V		sec
2F2	MAX_STARTS_PER_HOUR_NO_HOT	Maximum number of *compressor* start-ups in one hour	0...20	6	0	H	V		num
2F3	CPWR_UPDOWN_MIN_TIME_HOT	Safety protection time between downward *power stages*	0...300	10	0	H	V		sec
2F4	CPWR_DOWNUP_MIN_TIME_HOT	Safety protection time between upward *power stages*	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

Modbus address [hex]	Parameter Category and Name	Parameter description	Range	def	trans	C/H	vis	Description of code conversion	UM
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

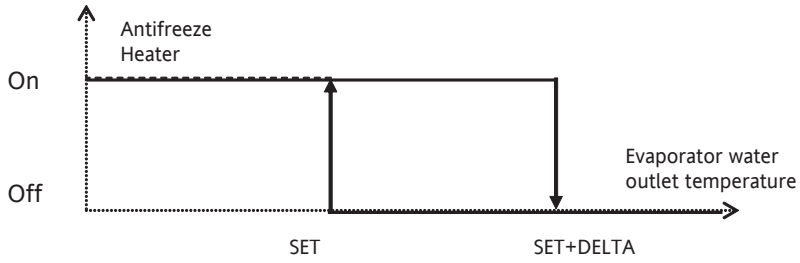
3.9 Antifreeze

3.9.1 Antifreeze prevention

If the machine is:

- started when cold (or going off from Cold mode) and parameter AFPR_COOLING_ENABLED_FLAG=yes;
- started when hot (or going down from Hot mode) and parameter AFPR_HEATING_ENABLED_FLAG=yes;
- started in Hot mode and at least one *circuit* of the machine is defrosting with the compressors On and parameter AFPR_ENABLED_DURING_*DEFROST*=yes;
- Off and parameter AFPR_OFF_STDBY_ENABLE_FLAG=yes (in this case, the *parameters* of the hot or cold 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* resistors according to the hysteresis function, where Set temperature is configured by AFPR_CHILLING_TSET/ AFPR_HEATING_TSET and Delta temperature is configured by AFPR_DELTA_TEMP as shown in the table.



SET	AFPR_CHILLING_TSET/ AFPR_HEATING_TSET
DELTA	AFPR_DELTA_TEMP
Water temperature at *evaporator* outlet	EV_TEMP_OUTWATER_SENS_i_PHY, i = *evaporator* number "i"
Antifreeze resistor	EV_HEATER_DO_i_PHY, i = *evaporator* number "i"

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

It at least one *evaporator* requires its *antifreeze* resistor to be switched on, the *antifreeze* resistors will be switched on in all the evaporators.
The *antifreeze* resistors are always off when in configuration mode, or if there is an error in the outlet water sensor of the *evaporator*, or if there is an alarm when parameter AF_USE_RESISTOR_FLAG is set to NO.
The hysteresis function is always re-initialized at Power On, when system status changes from Off to Cold, and when exiting configuration mode.

An error in this sensor causes the system to be blocked (including pump group and *antifreeze* resistors).

Note: activation of the resistors causes a request for activation 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 code conversion	UM
2C0	AFPR_COOLING_ENABLED_FLAG	Enable *antifreeze prevention* function if the system is On or going down (in Cold or Going Down mode)	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 down or heating	0...1	0	6	C	V	0=NO, 1=YES	Flag
2C6	AFPR_HEATING_TSET	*Antifreeze prevention* setpoint in Hot mode	-50.0...150.0	5.0	0	C	V		°C

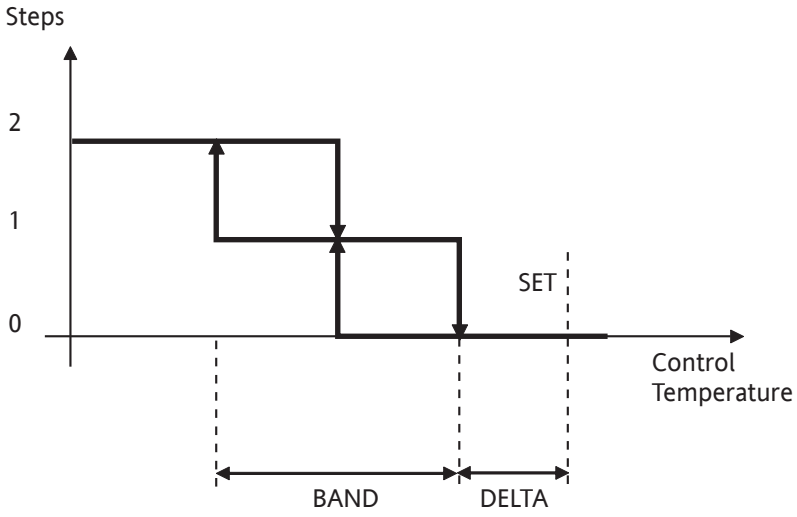
3.10 Integrated heating resistor

The integrated resistors are used in heat production systems (heat pumps) to increase the heat production capacity, especially during the system startup phase. The integrated resistors at the *evaporator* in a heat pump system are the same type as those used for the *antifreeze* function.
Use of the integrated resistors is enabled by the INTH_ENABLE_FLAG parameter, and the related controller operates according to the temperature of the primary *circuit* inlet water.
The resistors can be activated only if *:*

- the machine is Off;
- parameter INTH_ENABLE_FLAG=TRUE;
- there are no errors in the inlet water temperature sensor of the primary *circuit*;

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 resistors are switched on.

They are switched off if the temperature goes above HP_TSET_TEMP – INTH_DISPATCH_TEMP. For other temperatures, heat regulation is applied in steps as described below*:*



SET	HP_TSET_TEMP
DELTA	INTH_DISPATCH_TEMP
BANDA	INTH_PROP_BAND
Regulation temperature	PLAN_TEMP_INWATER_SENS
Steps	Number of resistors requested On

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 started, and if activation of two steps is requested, EV_HEATER_DO_1_PHY and EV_HEATER_DO_2_PHY are started.

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

3.11 Operating mode management

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

- OFF
- ON (in cold/hot mode)
- GOING DOWN

The user can select these using the keypad (PUSH: ON/) or a dedicated digital input PLAN_ON_DI_PHY. The system operating status selected on the keypad is stored in EEPROM so that it can be restored at the next Power On (after a power failure) or when the value of PLAN_ON_DI_PHY changes from true>false.

The digital input always takes priority when PLAN_ON_DI_PHY=true and causes the machine to be switched if On in Cold mode, or keeps it Off.

If PLAN_ON_DI_PHY=false, the system is switched On/ from the keypad using the ON/ toggle switch. Note that the Going Down phase cannot be stopped by an ON/ request from the keypad, which is therefore ignored.

The following table shows some special conditions for changes of system status.

	Active status	**Status in EEPROM**	**Timer 1**	**Timer 2**	**Remote ON**	
A	On	On	Not active	Not active	False->True	system changes to Going Down
B	On	On	Active	Not active	False->True (*)	system changes to Going Down mode and Timer 2 is re-started
C	Going down	On	Not active	Not active	True->False	system starts immediately (the heat regulator takes *control* of resources)
D	Going down	On	Not active	On	True->False	system starts and Timer 2 is re-started (the compressors remain until Timer 1 stops and are then controlled by the heat regulator).

Timer 1	PUMPGROUR_STARTUP_DELAY_TIME
Timer 2	PUMPGROUR_STOP_DELAY_TIME
Remote ON	PLAN_ONOFF_DI_PHY

(*) or the ON/ button is pressed

The machine operating status changes from GOING DOWN to when all compressors are , the pump is and dripping has ended (if defrosting was active).

Note if there is a power failure during the Going Down phase, the machine starts from Off at the next Power On.

3.12 Mode change management (SUMMER/WINTER)

Summer/winter mode can be selected either by digital input PLAN_MODE_DI_PHY if parameter PLAN_MODE_DI_ENABLE_FLAG is enabled, or from the keypad by changing parameter PLAN_MODE_MANUAL.
The digital input has priority over the PLAN_MODE_MANUAL parameter.
The mode can be changed either with the machine either Off or On: in the latter case, the machine goes down automatically and then re-starts in the new mode.
In both cases, i.e. if the machine is On or Off, all machine statuses and alarms are re-initialized.
Once initiated, the mode change procedure cannot be stopped by another mode change. The machine will therefore go Off in the current mode, go into the last mode selected, then re-start (unless Off is requested by digital input or by the status in EEPROM). Therefore, if a machine Off is requested during the mode change procedure (for example by digital input), when the machine goes Off, the *reverse cycle valve*s will go into the status corresponding to 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 code conversion	UM
223	PLAN_MODE_DI_ENABLE_FLAG	Enable mode setting by digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
249	PLAN_MODE_MANUAL	Summer/winter mode from keypad	0...1	0	27	C	V	0=CHILLER 1=HEAT PUMP	num

4 ALARMS HISTORY

The *alarms history* is enabled by the HISTORY_ENABLE_FLAG parameter. Disabling the history does not erase it. To do this, please see 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 hold up to 50 alarms.
When a new alarm is activated, it is immediately entered in the *alarms history*. If the alarm is already present in the history and it has occurred within the same hour, the hourly frequency of the alarm is incremented. The maximum value of the hourly frequency is 99. If there are at least 50 alarms in the queue and a new alarm is entered, the data for the oldest alarm are erased.
The following data are stored for each alarm:

- Alarm identification code (xy) and system index (zw): Exyzw
- Hour of activation: hh
- Date of activation: dd/mm/yy
- Hourly frequency, i.e. the number of times activated per 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
Error in inlet water temperature sensor	00	00
Error in outlet water temperature sensor	01	00
Dynamic setpoint current sensor error	02	00
System *high temperature alarm*	03	00
System *low temperature alarm*	04	00
Error in *circuit* maximum pressure sensor	05	01...04
Circuit maximum pressure alarm	06	01...04
Circuit minimum pressure alarm	07	01...04
Error in compressor discharge temperature sensor	08	01...04
Compressor thermal protection alarm	09	01...04
Compressor discharge temperature alarm	10	01...04
Pump thermal alarm	11	01...02
Flow switch automatic and/or blocking alarm	12	00
Fan battery thermal alarm	13	01...02
Error in outlet water temperature sensor of *evaporator*	14	01...02
Evaporator antifreeze alarm	15	01...02

For example, the maximum pressure alarm of *circuit* 3 will have identification code E0603

4.2 Displaying the alarms history

The *alarms history* can be displayed using the keypad and the special menu. When first opened, the oldest alarm entered in the history is shown (with list number 1). The ENTER key on the keypad is used to scroll through the *alarms history* towards the most recent. The last alarm stored will have the same list number as the total number of alarms stored in memory. The total number of alarms in the history is shown on the right of the list number of the alarm being displayed. If the history display menu is opened after navigating around the history, and in the mean time a new alarm has been entered, thus "shifting" the place of the alarm in the list, the display will show the updated list number.

4.3 Unloading the alarms history with a 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, and parameter E2_HISTORY_OLDEST gives the number of the oldest alarm in the queue (starting from 0).
If E2_HISTORY_NUM is less than 50, for example 7, simply read strings E2_HISTORY_1 to E2_HISTORY_6 to unload the history completely.
If E2_HISTORY_NUM is 50, and E2_HISTORY_OLDEST is 7 for example, simply read strings E2_HISTORY_7 to E2_HISTORY_50 and E2_HISTORY_1 to E2_HISTORY_6 in order 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 when the history has been "unlocked" by resetting the HistoryLocked variable. In all cases, the HistoryReqLocked and HistoryLocked variables are reset automatically by the application if the HistoryReqLocked variable has not been reset within 60sec (maximum time allowed for unloading the *alarms history*). For the serial commands, please refer to the manual concerned.

4.4 Erasing the alarms history

The *alarms history* can be erased from the keypad, by selecting the “Erase History” item on the Alarms menu. With a serial command, simply set the VAR_BOO_BIOS_37 variable to 1. The variable itself 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 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
6F1	E2_HISTORY_NUM_HOT	Number of alarms entered in the *alarms history*. If its value is zero, the history is empty. If its value if 50, the history is full.	0...50	0	0	H	N		num
6F2	E2_HISTORY_1_HOT	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
6F3...	E2_HISTORY_2_HOT	20 character alarm history, with value 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 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
729	HISTORY_ENABLE_FLAG	Enable alarm history	0...1	0	6	C		0=NO; 1=YES	flag

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

5 BLACK BOX

5.1 General

Function used, when there is an event, to record the operating status of the machine in the form of a file in non-volatile memory. The events that cause machine status to be stored are as follows:

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

While a new event is being diagnosed, all other events are ignored until the complete collection has been stored. The maximum number of collections is three. The three collections in memory are always the three stored most recently, using circular queue logic.

5.2 Parameters available

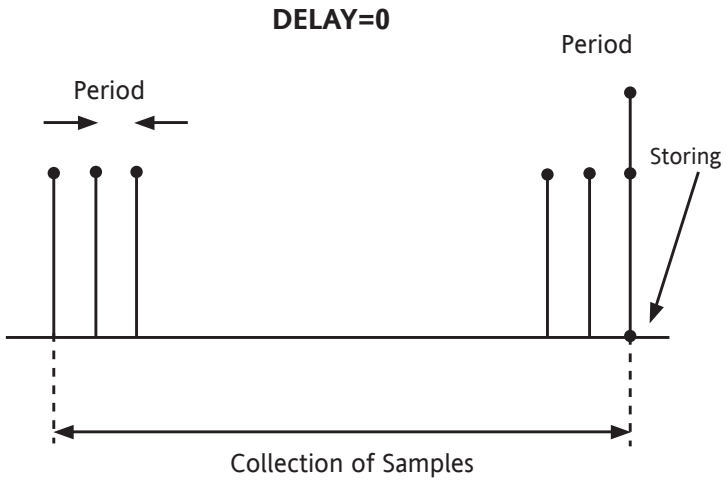
- BBX_ENABLE_FLAG — enable blackbox function [0,1]. Disabling this function does not delete the collections already stored, but resets the *alarms specific to the blackbox* and resets the circular queue for samples in RAM
- BBX_INTERVAL_TIME — sampling interval for blackbox [60sec,250sec]
- BBX_DELAY — Delay for storing samples for the blackbox [0,20]

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

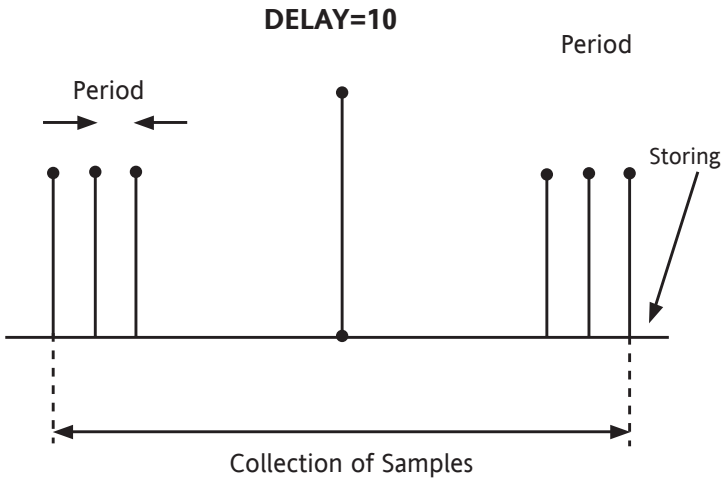
The collection of samples (NUMERO CAMPIONI) is continuously updated in a circular queue in RAM, at frequency 1/BBX_INTERVAL_TIME. When there is an event, the whole collection is stored in non-volatile memory in the form of a file, at a delay that can be defined with parameter BBX_DELAY.

The following diagrams show a few examples of storage in memory according to the setting of parameter BBX_DELAY.

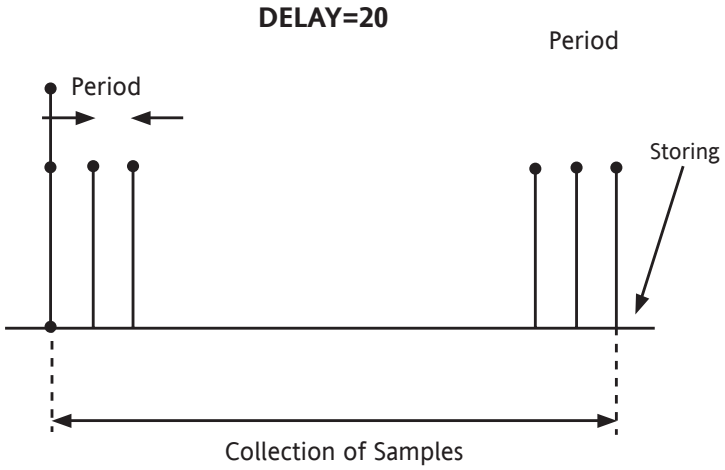
The collection of samples (NUMERO CAMPIONI) is stored in full when an event has occurred (BBX_DELAY=0):



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



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



5.3 Description of the collections stored

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

The HEADER consists of:

Value detected	Number of characters for the value detected	Description
BbxCode	2	Alarm identification code
'/'	1	Separator
BbxIdx	1	System index
'/'	1	Separator
BbxDateAndTime	20	Date and time
'/'	1	Separator
BBX_DELAY	3	Delay for storing the collection
'/'	1	Separator
BBX_INTERVAL_TIME	2	Sampling interval 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 shown 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 alarm	11	01…02
Flow switch automatic and/or blocking alarm	12	00
Fan battery thermal alarm	13	01…02
Evaporator antifreeze alarm	15	01…02

The SAMPLES consist of:

Value detected	Number of characters for the value detected
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 detected	Number of characters for the value detected
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

Value detected	Number of characters for the value detected
KompTempDischargeSensErr[0]	1
KompTherA[0]	1
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 value varies according to the structural configuration *parameters* for the machine. The sample shown represents the one for the maximum machine.

The following example shows 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 with a serial command

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, while 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 is not to be taken into consideration, as the oldest file is 000.txt.
If E2_BBX_FILE_NUM is less than 3, for example 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 001.txt, 002.txt and 000.txt must be read in sequence in order to unload the blackbox completely.
In order to prevent new collections being entered in the blackbox during the unloading process, the history function must be temporarily disabled. This is done by setting the BbxReqLocked (Modbus address 626) to 1 and waiting for the application to set the BbxLocked variable (Modbus address 625) to a 1. The blackbox can now be unloaded. Afterwards, the BbxReqLocked variable must be reset, in order to “unlock” the blackbox. The application indicates when the blackbox has been “unlocked” by resetting the BbxLocked variable. In all cases, the BbxReqLocked and BbxLocked variables are reset automatically by the application if the BbxReqLocked variable is not reset within 180sec (maximum time allowed for unloaded 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) from the keypad, by selecting the “Erase blackbox” item on the alarms menu. With a serial command, simply set the VAR_BOO_BIOS_39 variable to 1. The variable itself will be reset by the application. The blackbox Erase process is separate from the blackbox Enable parameter and can be carried out only after the current Save process has been completed. *Erasing the blackbox* 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:

- Error opening file
- File write error
- Error closing file

Modbus address (hex)	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	UM
724	E2_BBX_FILE_OLDEST_HOT	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 should not be taken into consideration as the oldest file is always 000.txt.	0...2	0	0	H	N		num
725	E2_BBX_FILE_NUM_HOT	Number of files entered in the blackbox. If zero, the blackbox is empty. If the value is 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 Hot 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 causing a risk of damage to the machine.

6.1 Types of defrost

Defrosting can be carried out in the reverse cycle, and in one mode, called “Standard” mode”.
This is similar to the one applied 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 one *reverse cycle valve* on each *circuit*
(CIR_INVERSION_VALVE_DO_i_PHY, i = *circuit* number "i"). If a *circuit* is defrosting, its *reverse cycle valve* is deactivated (CIR_INVERSION_VALVE_DO_i_PHY = FALSE, i = number of *defrost circuit*).
The figure below illustrates the *Defrost* and Drip times and shows how the *reverse cycle valve functions*. For the *Circuit* and *Fans*, please refer to the next sections

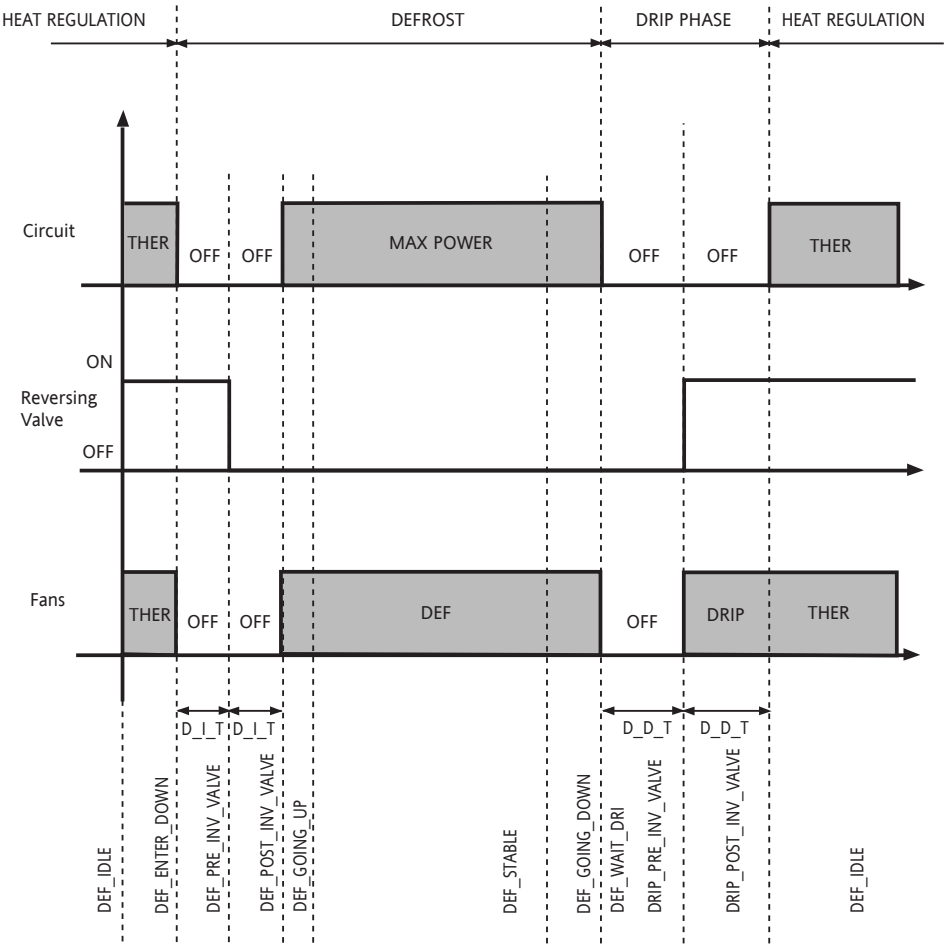


Fig.6.1

D_I_T:	DF_INVERSION_TIME
D_D_T:	DF_DRIP_TIME

6.2 Conditions for starting the defrost function

The conditions required for going into *defrost* are as follows:

- When the pressure detected by the maximum pressure sensor on *circuit* "i" (CIR_PRES_MAX_SENS_i_PHY) goes below the value of parameter DF_START_PRES (*defrost* start pressure) and the *circuit* is supplying at least one power step, the *defrost* delay time counter is started and counts the time value set with parameter DF_START_DELAY_TIME.
- If the pressure goes back above the value of parameter DF_START_PRES (*defrost* start pressure) or the *circuit* is not supplying any power steps, the delay time counter is stopped.
- The counter of the *defrost* delay time (DF_START_DELAY_TIME) is reset after a *defrost* cycle, after a Power Down, after a mode change, or if the system is started or stopped from the keypad.
- The *defrost* delay time counter (DF_START_DELAY_TIME) is reset if the pressure goes above the value of parameter DF_STOP_PRES (*defrost* stop pressure).

- When the delay time count is completed, 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 the *defrost* are still present (*circuit* is supplying at least one power step), then the circuits start to switch Off; after they have switched Off, *defrost* runs for the maximum time set by parameter DF_MAX_DURATION_TIME and minimum time set by parameter DF_MIN_DURATION_TIME. When defrosting starts, the *compressor* safety protection times are reset with the values set for the *defrost* function by parameter (DF_INTER_STEP_TIME). The number of *compressor* start-ups per hour is set to zero and re-armed, to count the number of start-ups during *defrost*. The *compressor* safety protection times (minimum ON time and minimum OFF time) are then "disabled" until the *defrost* stop conditions are detected. The purpose of this is to make the defrosting process as rapid as possible.
- The time from the end of the last *defrost* of the *circuit* until the start of the next *defrost* must be at least the value set by parameter 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 the system is started or stopped from the keypad.

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

6.3 Control during defrost

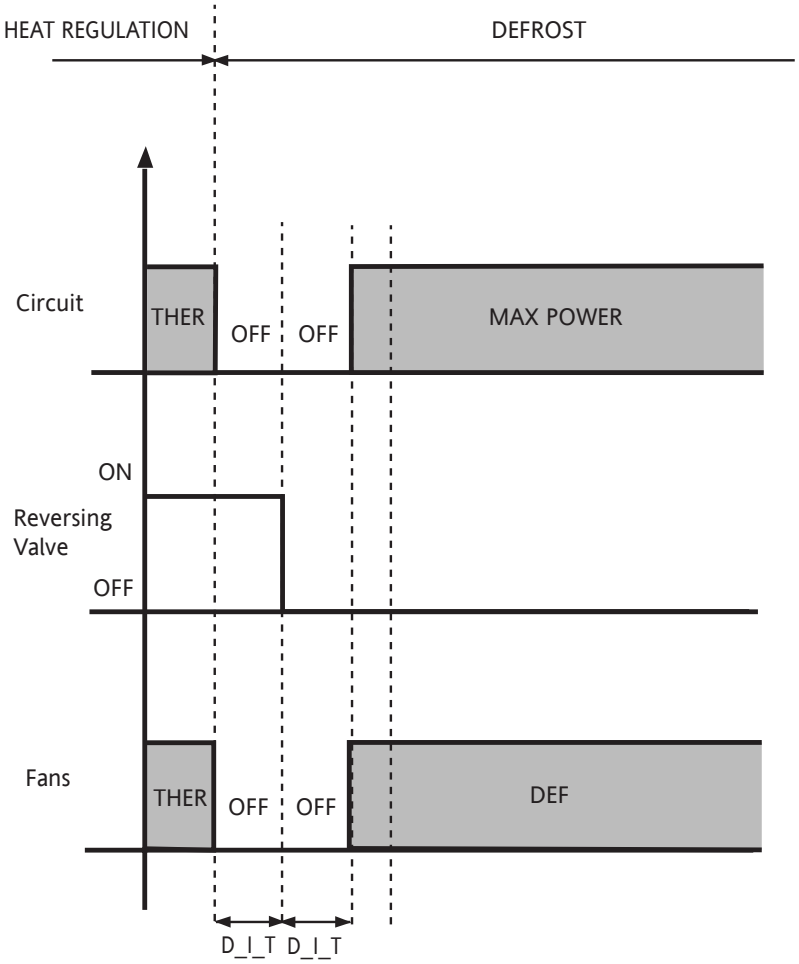


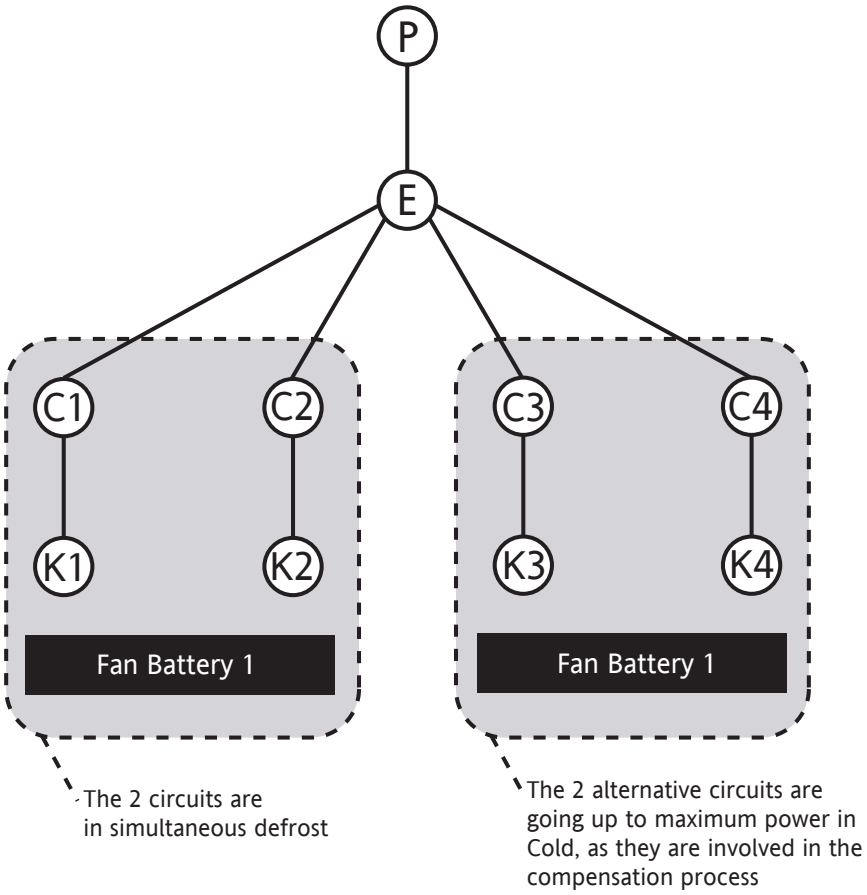
Fig 6.3

D_I_T:	DF_INVERSION_TIME
D_I_T:	DF_INVERSION_TIME
D_I_T:	DF_INVERSION_TIME

6.3.1 Circuit

At the start of *defrost*, if time DF_INVERSION_TIME is different from zero, heat regulation is carried out as shown in Figure 6.3: at the start of *defrost*, the *circuit* is powered down (DEF_IDLE→ DEF_ENTER_DOWN). When it has gone Off (its compressors are Off), the delay time in parameter DF_INVERSION_TIME (DEF_ENTER_DOWN → DEF_PRE_INV_VALVE) is counted, after which the *reverse cycle valve* for the *circuit* is reversed (CIR_INVERSION_VALVE_DO_i_PHY, i = number of the *circuit*). Another delay time is then counted, for time DF_INVERSION_TIME (DEF_PRE_INV_VALVE→ DEF_POST_INV_VALVE), after which the *circuit* re-starts (DEF_PRE_INV_VALVE→ DEF_GOING_UP).
If DF_INVERSION_TIME = 0, any *compressor*(s) that may be 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 they reach their maximum power output (DEF_GOING_UP→ DEF_STABLE). The time defined by parameter DF_INTER_STEP_TIME is applied between the power steps of the compressors (MAX POWER zone of the *Circuit* in the Figure).
Note that if at least one *circuit* has not yet reached full power in *defrost*, and the conditions for stopping *defrost* are detected for any of the circuits, defrosting is stopped and the circuits are switched off, applying the times between steps for *defrost* (DF_INTER_STEP_TIME) and the following drip phase.
Obviously, the compressors in circuits not involved in the *defrost* are (or remain) activated by the heat regulator, according to the standard heat regulation policies. This is unless there is a request for the compensation function by the DF_MAX_POWER_FLAG parameter, which activates the compressors at full power in the alternative circuits that are not in *defrost*.
The alternative circuits are those belonging to the same *evaporator* block in which the *defrost circuit* is located, but which are not connected to the fan battery involved in the defrosting.
Below is an example of a 1-4-4 reversible machine, where parameter DF_MAX_POWER_FLAG is set to YES *:*



6.3.2 Reverse cycle valve

At start of *defrost*, the *reverse cycle valve* is actuated as described in the Compressors section.
From the time that the valve is reversed, the bypass time defined by parameter DF_BYPASS_MIN_TIME is counted for minimum pressure alarms on the *circuit* involved.
Note that each time there is a change of position of the *reverse cycle valve* on the *circuit*, the minimum pressure alarm bypass time is set to whichever value of A_MIN_PRES_BYPASS_TIME and DF_BYPASS_MIN_TIME is the largest.

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 value of that parameter (fan OFF zones in Figure 4.2). After this time has elapsed, if the pressure detected (the highest of the values CIR_PRES_MAX_SENS_i_PHY detected by the sensors, where "i" is the number of the circuits involved in the *defrost*) goes above 'start *fans* in *defrost*' threshold DF_MAX_FANSP_PRES, the *fans* are activated at full power. If the pressure goes 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 phase, but are controlled directly as in *defrost*.
.

6.4 Conditions for stopping the defrost function

Defrosting is stopped *:*

- When the current *defrost* has reached the maximum duration defined by DF_MAX_DURATION_TIME (maximum *defrost* time).

- If the *defrost* pressure goes above DF_STOP_PRES (*defrost* pressure) and time DF_MIN_DURATION_TIME has elapsed (minimum *defrost* time).

The conditions described above are evaluated when the defrosting power is rising (DEF_GOING_UP) or stable at maximum (DEF_STABLE). The minimum safety protection times for which the compressors remain ON and OFF are applied again: the ON time for the next start-up and the OFF time for each *compressor* coming out of *defrost*

6.5 Control while coming out of defrost and during the drip time

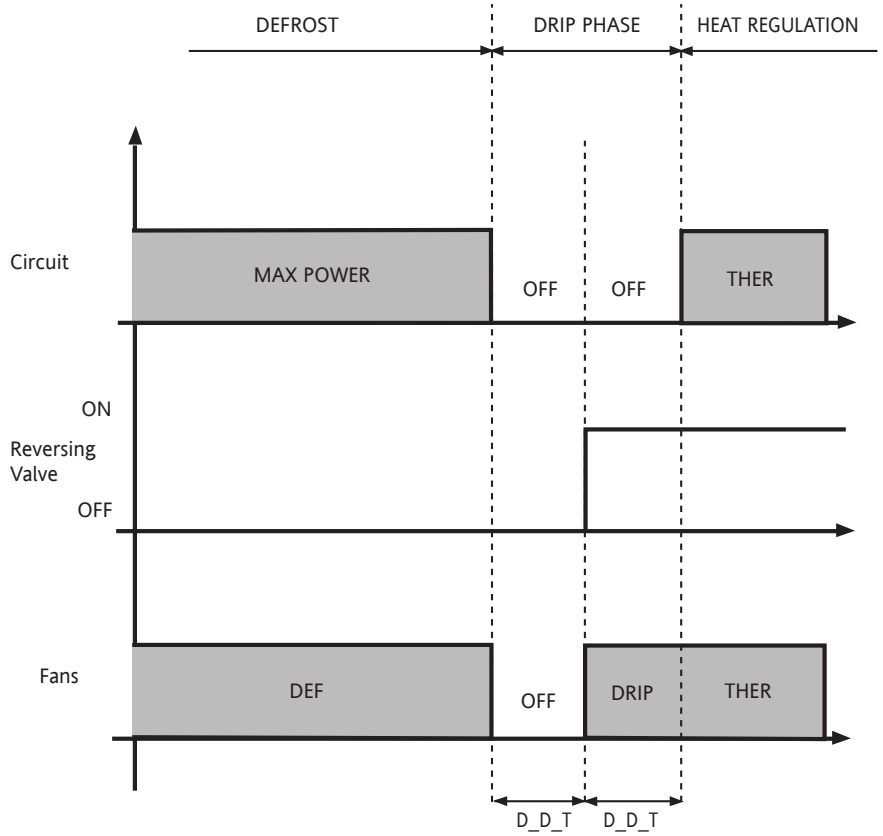


Fig.6.5

D_D_T:	DF_DRIP_TIME

6.5.1 Circuit

At the end of *defrost*, if time DF_DRIP_TIME <> 0, heat regulation is carried out as shown in the figure.
The power steps of compressors in the *circuit* that is coming out of *defrost* are switched off, applying the time set by parameter DF_INTER_STEP_TIME (DEF_STABLE→DEF_GOING_DOWN). When the *circuit* is Off, delay time DF_DRIP_TIME (DEF_GOING_DOWN DRIP_PRE_INV_VALVE) is counted, after which the *circuit*'s *reverse cycle valve* is reversed (CIR_INVERSION_VALVE_DO_i_PHY, i = number of the *circuit*). Another delay time defined by DF_DRIP_TIME (DRIP_PRE_INV_VALVE→ DRIP_POST_INV_VALVE) is then counted, after which the *circuit* comes back under *control* of the heat regulator (*circuit* THER zone shown in Figure 5.6 DRIP_POST_INV_VALVE→ DEF_IDLE).
Timer DF_MIN_REST_TIME is then started.
If DF_DRIP_TIME = 0, any compressors that are On the *circuit* being defrosted come immediately under the *control* of the heat regulator (DEF_STABLE→ DEF_IDLE). In the case of simultaneous *defrost* and if DF_DRIP_TIME<>0, and if a *circuit* has completed the *defrost* cycle (DEF_GOING_DOWN→ DEF_WAIT_DRIP) and the *compressor*(s is/are Off, these remain Off until the last *circuit* has finished defrosting (DEF_WAIT_DRIP→ DRIP_PRE_INV_VALVE) The circuits in which the compensation function was active come back under *control* of the Hot mode heat regulator after the drip time has ended. However, if DF_DRIP_TIME=0, all circuits come back under *control* of the heat regulator only when the last *circuit* goes off.

6.5.2 Reverse cycle valve

At the end of *defrost*, the *reverse cycle valve* is reversed as described in the Compressors section.
From the time that the valve is reversed, the bypass time defined by parameter DF_BYPASS_MIN_TIME is counted for minimum pressure alarms on the *circuit* involved.
Note that each time the position of the valve on the *circuit* changes, the bypass time for minimum pressure alarms is still controlled by parameter A_MIN_PRES_BYPASS_TIME.

6.5.3 Fans

During the drip time, the *fans* are switched Off before the *reverse cycle valve* is reversed. From the time that 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 to full power.
At the end of time DF_DRIP_TIME, the *fans* are controlled by the fan regulator in Hot mode (*Fans* THER zone in the Figure)

6.6 ON/OFF control during defrost

If the system is switched Off after activating the *defrost* start procedure, but before the circuits involved in the *defrost* change from Off to On to go up to maximum power (DEF_ENTER_DOWN, DEF_PRE_INV_VALVE, DEF_POST_INV_VALVE), the system immediately comes out of *defrost* and skips the drip phase (DEF_IDLE). The circuits are then immediately ready to go into a new *defrost* cycle, since the time between successive defrosts has not been initiated.

If the system is switched Off while the circuits are going up to full power in *defrost* (DEF_GOING_UP), or are already stable at full power (DEF_STABLE), the circuits are powered down (DEF_GOING_UP→ DEF_GOING_DOWN) and go into the drip phase.
If the system does not go through the Off phase, then the time between successive defrosts is applied, otherwise, at the next start-up of the machine, the circuits are immediately ready for to go into *defrost* if necessary.

In particular, in the following situations:

- system changes from On to Off ;
- at the next Power On;
- when exiting from configuration mode;

the delay time between one *defrost* and the next (DF_MIN_REST_TIME) is reset, in order to allow an immediate *defrost* if necessary, and the delay time for starting to *defrost* (DF_START_DELAY_TIME) is reset

Modbus address (hex)	Parameter Category and Name	Parameter description	Range	default	trans	C/H	vis	Description of code conversion	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 the drip cycle	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 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 turning of the *reverse cycle valve* - change of position of the *reverse cycle valve* and time the *circuit* goes into *Defrost*.	0...1000	30	0	C	V		sec
427	DF_START_PRES	Pressure value at which defrosting is activated if 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	Time before starting to *defrost* when pressure remains below value DF_START_PRES	0...60	30	0	C	V		min
429	DF_STOP_PRES	Pressure value at which defrosting stops	0.0...5.0	12.0	0	C	V		bar
42A	DF_MIN_DURATION_TIME	Minimum time for which defrosting is to continue	0...30	5	0	C	V		min
42B	DF_MAX_DURATION_TIME	Maximum time for which defrosting is to continue	0...60	30	0	C	V		min
42C	DF_BYPASS_MIN_TIME	Bypass time for minimum pressure alarm at the start of *defrost*	0...30	5	0	C	V		min
42D	DF_MAX_FANSP_PRES	Pressure value beyond which the *fans* go up to maximum power during *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

7 DIAGNOSTICS

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

If a sensor is not being used by any of the *functions*, it cannot generate any sensor error alarms, 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 *control* conditions:

- *antifreeze alarm*s and the alarms for the pumps (flow switch and *pump thermal alarm*s); for more information about, please refer to the related chapters.
- BIOS alarms, which are always managed (if the system is off, the *cumulative alarm relay* is not set off if the BIOS alarm is active. The *red LED* on the keypad comes on 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, not otherwise;
- Manual: the alarm is active as long as the cause of the alarm is present, otherwise it can be rest manually;
- Event bounded: the alarm behaves like an automatic alarm as long as the number of events in the time unit is below the number configured, otherwise it behaves like a manual alarm;
- Time bounded: the alarm behaves like an automatic alarm as long as the activation status is below the time configured, otherwise it behaves like a manual alarm;

7.2 Indications the event of an alarm or error

7.2.1 Red LED

Sensor alarms and/or errors are indicated 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 re-settable alarms are present, and remains off in other cases. The status of the LED 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 re-settable or active alarms is indicated by activation of the *cumulative alarm relay* (PLAN_CUMALARM_DO_PHY). The relay *functions* even when the system is in Off mode (obviously, only for alarms that are active when the system if off).

7.3 Heat regulation alarms

7.3.1 High temperature alarm

If the temperature value measured by the inlet water sensor of the primary *circuit* (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 cold mode, then the *high temperature alarm* is generated. This is a system blocking alarm. The alarm is re-armed manually.

If one of the following conditions is present:

- Function disabled (A_HIGHT_ENABLE_FLAG=false);
- error in water inlet sensor of primary *circuit;*
- *system Off;*

the alarm remains Off.

The alarm is reset and re-armed:

- manually if re-settable
- the system is started or going down;
- exit from configuration mode;
- by a reset;

7.3.2 Low temperature alarm

If the value of the temperature measured by the water inlet sensor of the *primary circuit* (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, then the *low temperature alarm* is generated. This is a system blocking alarm.
The alarm is re-armed manually.

If one of the following conditions is present:

- Function disabled (A_LOWT_ENABLE_FLAG=false);
- error in water inlet sensor of primary *circuit*;
- *system Off*;

the alarm remains Off.

The alarm is reset and re-armed:

- manually if re-settable
- the system is started or going down;
- exit from configuration mode;
- by a reset

7.3.3 Water inlet sensor error

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

7.3.4 Outlet water sensor error

If heat regulation is performed through the outlet water temperature sensor (TREG_TEMP_SENS = EXIT_SENS), an error condition in this sensor causes the system to be blocked. If heat regulation is performed 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 Related parameters

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of code conversion	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		Bypass time for system *low temperature alarm*
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 inlet water temperature on the primary circuit)*
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* *(this alarm monitors the inlet water temperature on the primary circuit)*
247	A_LOWT_THRESHOLD_TEMP_HOT	-15.0...50.0	30.0	V	0	°C	H		Setpoint for system *low temperature alarm*

7.4 Circuit management alarms

7.4.1 Errors and alarms in circuit maximum pressure sensor

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=*circuit* number "i".

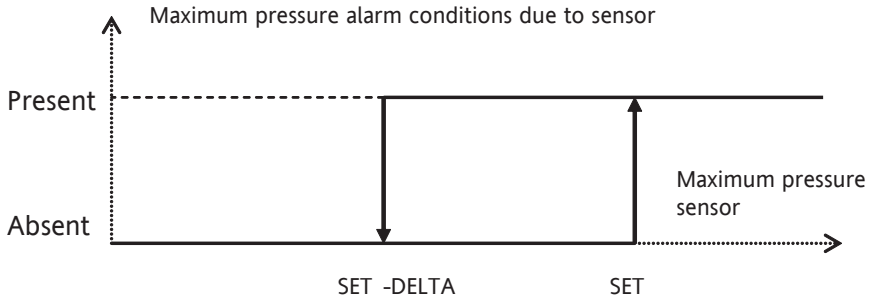


Fig 7.4.1

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

When the system is Off , the alarm remains Off.
When the system is started in Cold mode, or when going down, the alarm is controlled by the hysteresis function shown in Fig 7.4.1, in OR logic with the status of digital input 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 started or going down;
- exit from configuration mode;
- by a reset;
- error in maximum pressure sensor;

If there is an error in the *circuit* maximum pressure sensor, the *circuit* concerned is blocked. If the maximum pressure switch is not actuated, 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 all cases, the *circuit* is blocked by the sensor error.

7.4.2 Circuit minimum pressure alarm

Control of the minimum pressure alarm condition is enabled if:

- machine is started 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 minimum pressure digital input CIR_PRES_MIN_DI_i_PHY, where i=*circuit* number "i".

The alarm is bypassed for time A_MIN_PRES_BYPASS_TIME _HOT, which is loaded each time there is a change in the power applied to the *circuit* not due to the alarm itself

The alarm is re-armed automatically. If the number of responses from the alarm in one hour is above the value of parameter MAX_MINP_ALARMS_NO, the alarm then has to be re-armed manually. Start-ups are stored in memory with a time resolution of 3600/32 seconds.

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

Alarm management is always re-initialized and the alarm is reset:

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

7.4.3 Related parameters

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of code conversion	Parameter description
2E0	A_MAX_PRES	0.0...50.0	28.0	V	0	Bar	C		Setpoint for *circuit* maximum pressure alarm
2E1	A_MAX_DELTA_PRES	0.0...10.0	2.0	V	0	Bar	C		Delta for *circuit* maximum pressure alarm
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		Bypass time for minimum pressure alarm

7.5 Fans thermal alarm

A single thermal alarm input is provided per battery, irrespective of the number of *fans* in the battery.
A response by the thermal protection of the fan battery always causes the immediate blocking of the battery and all compressors belonging to the same circuits as the *fans* concerned. The alarm is re-armed manually.

7.6 Hydraulic pump control alarms

7.6.1 Flow switch alarm

Management of this alarm is enabled if the machine is started in Cold mode or going down, or if the heating resistors are On (*antifreeze* or frost prevention).

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

Parameter **A_FS_EXIT_TIME** defines the time interval (after a flow switch logic alarm has occurred) for which the *flow switch alarm* must not recur continuously until the logic alarm condition is considered to have been reset.

A_FS_AUTOMATIC2MANUAL_TIME defines the time for which the logic alarm must persist until the alarm management changes from automatic to manual.

7.6.2 Pump thermal alarm

Management of this alarm is enabled if the machine is started or going down, or if the heating resistors are On (*antifreeze* or frost prevention).
The *pump thermal alarm* is a manual reset alarm, which blocks the pump currently in use.

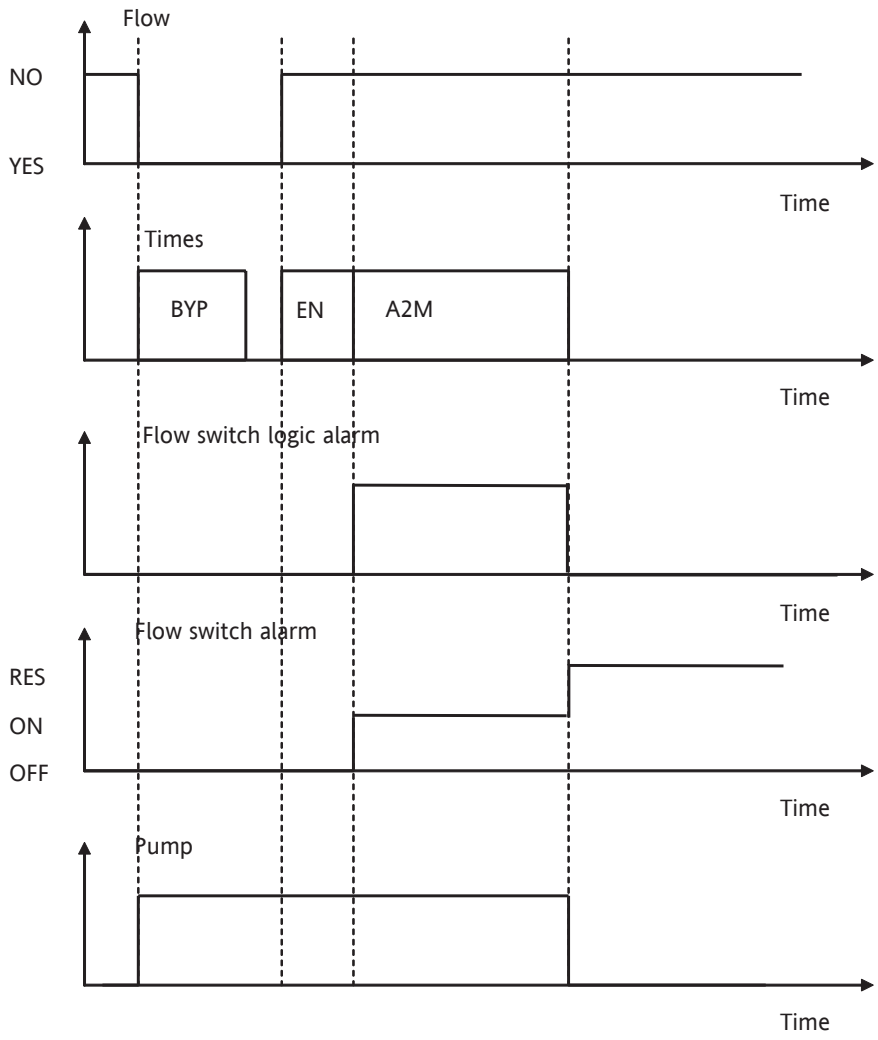
7.6.3 Pump management if there is a pump thermal protection or flow switch alarm

If there is a flow switch logic alarm or a pump thermal protection has been actuated, 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 actuated, the system is blocked immediately 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**

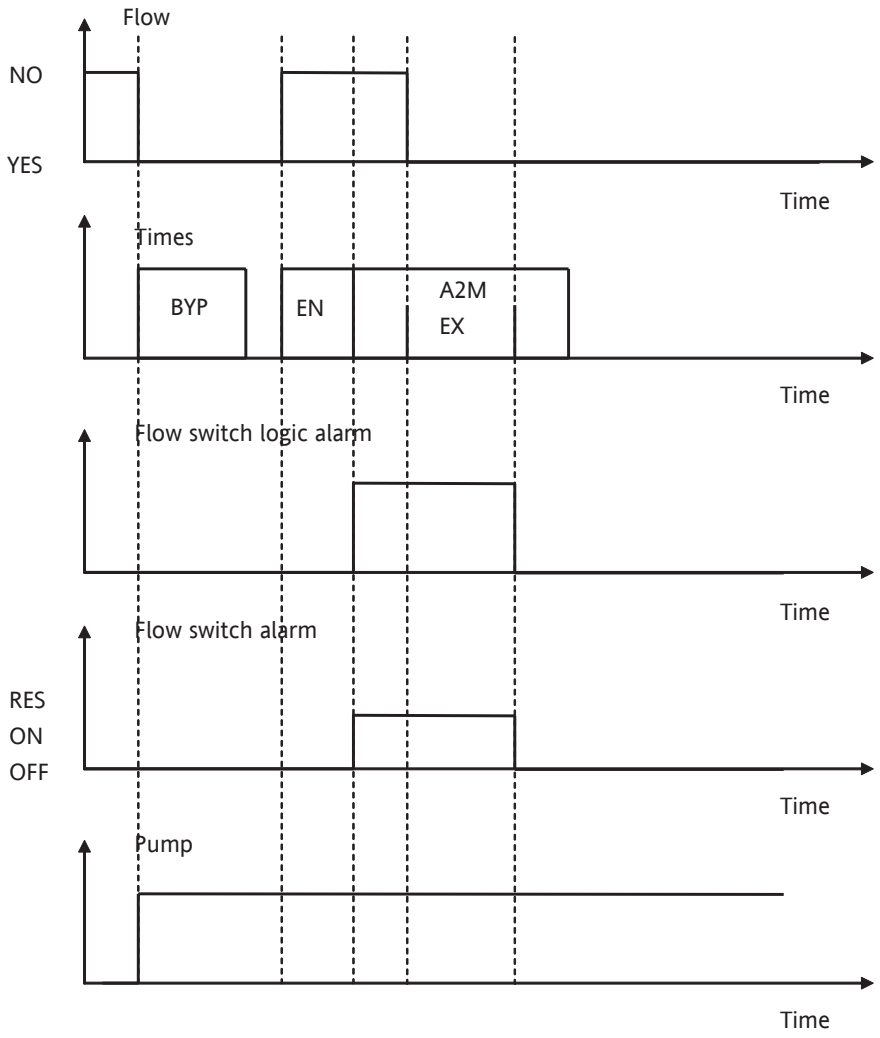


Flow	PUMP_A_FLOW_DI_PHY
Pump 1	PUMP_ACC_DO_1_PHY

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

- The alarm condition is reset :
- by a manual reset
- by changing from On to Off (using the remote ON/OFF keypad);
- at the next Power On;
- when exiting from configuration mode;

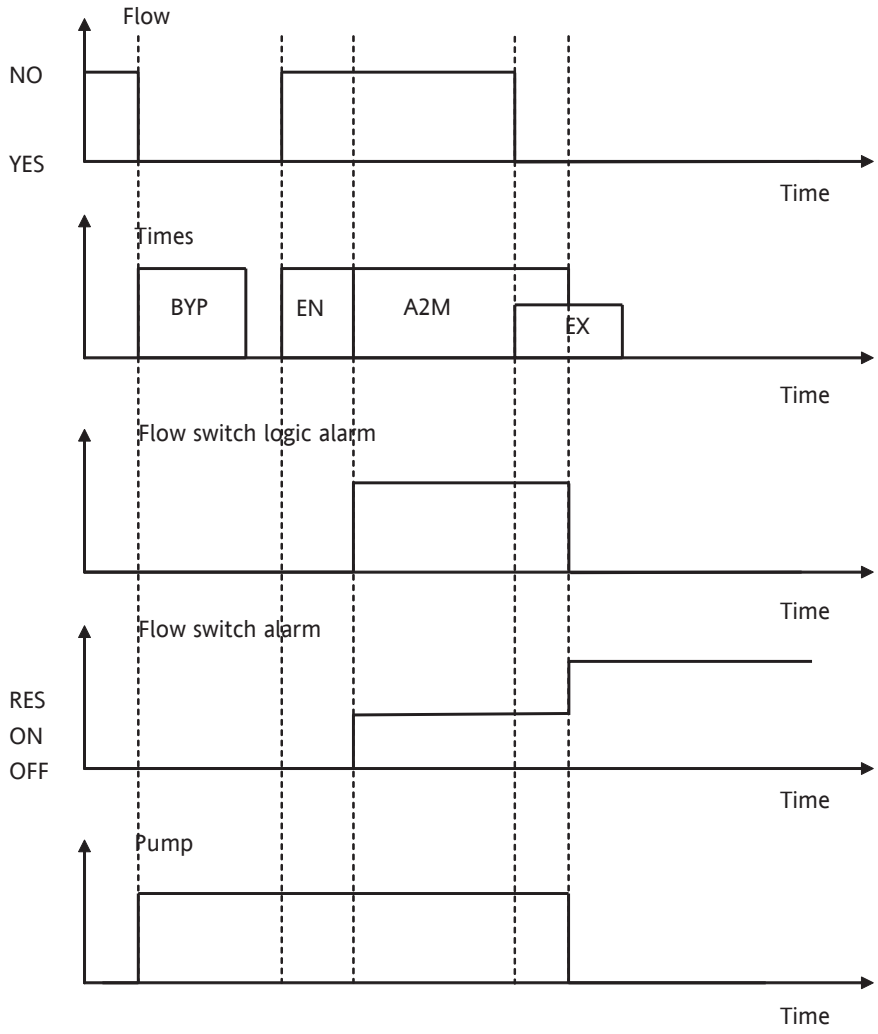
Flow switch logic alarm rest before time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



Flow	PUMP_A_FLOW_DI_PHY
Pump 1	PUMP_ACC_DO_1_PHY

In this case, the alarm goes into automatic mode without blocking the system.

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

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

The alarm condition is reset :

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

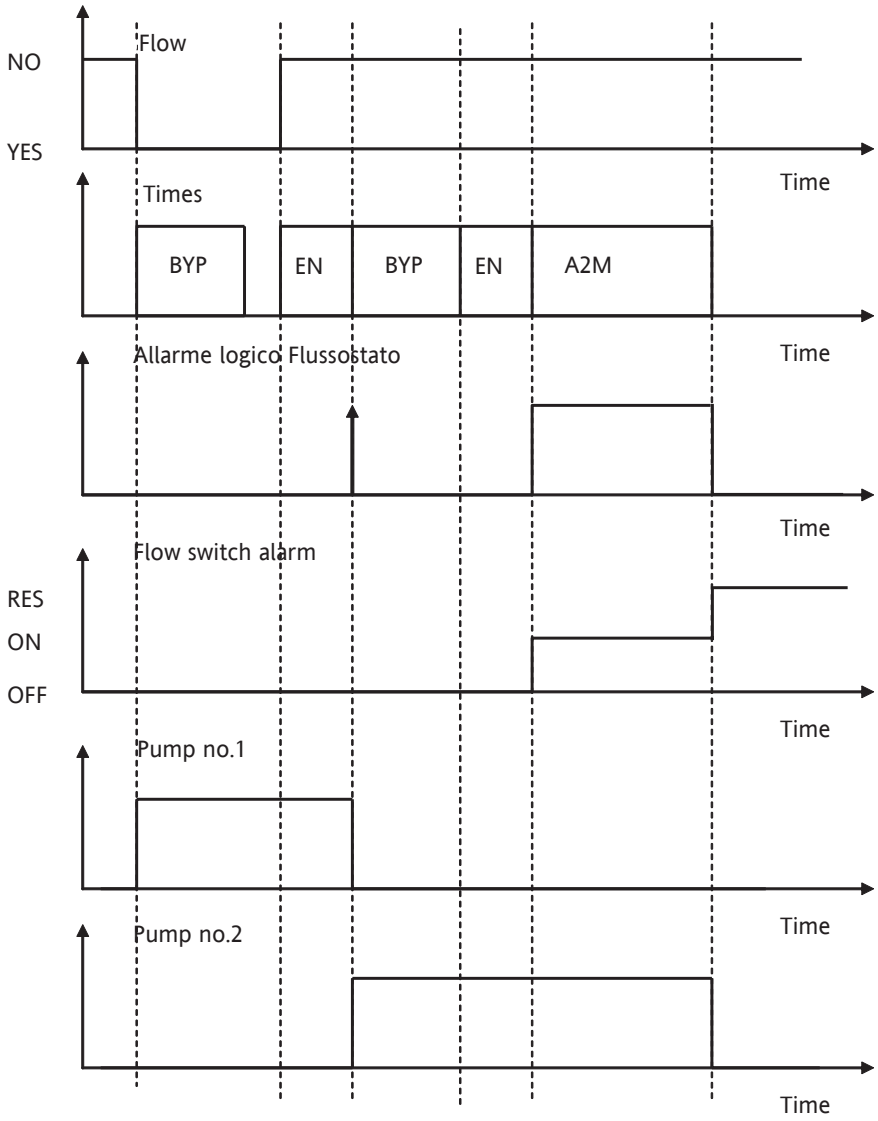
7.6.3.2 PUMPS_NO=2

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

7.6.4 Pump not available alarm

If there has been a pump “swap due to alarm” in the pump group, for example because of a *flow switch alarm*, and the second pump is able to ensure the flow, a "not available" alarm is declared for the first pump. This alarm can always be reset manually.

Flow switch alarm **always active**

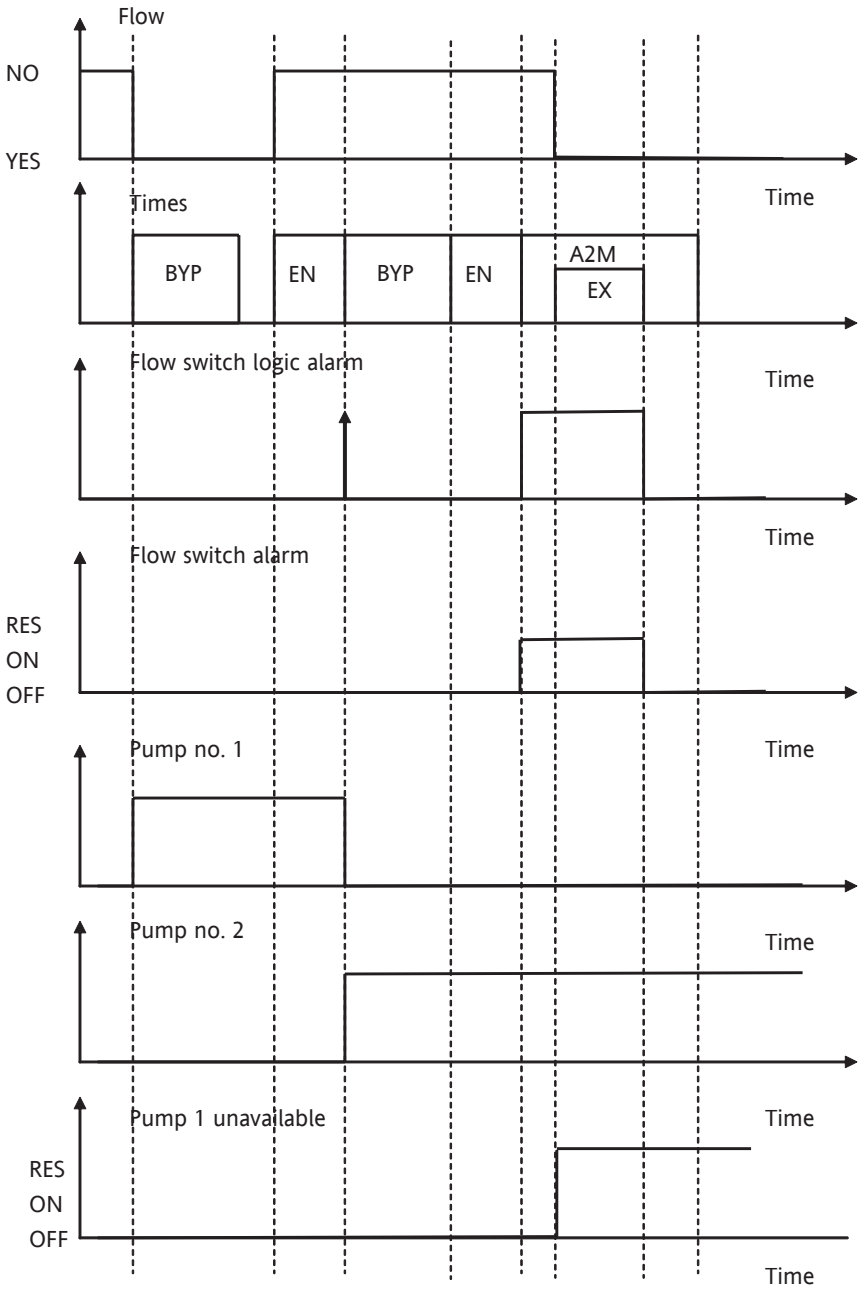


Flow	PUMP_A_FLOW_DI_PHY
Pump 1	PUMP_ACC_DO_1_PHY
Pump 2	PUMP_ACC_DO_2_PHY

Note that the system is also blocked when pump 2 goes off.
The alarm condition is reset :

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

Flow switch logic alarm reset before time A_FS_AUTOMATIC2MANUAL_TIME has elapsed



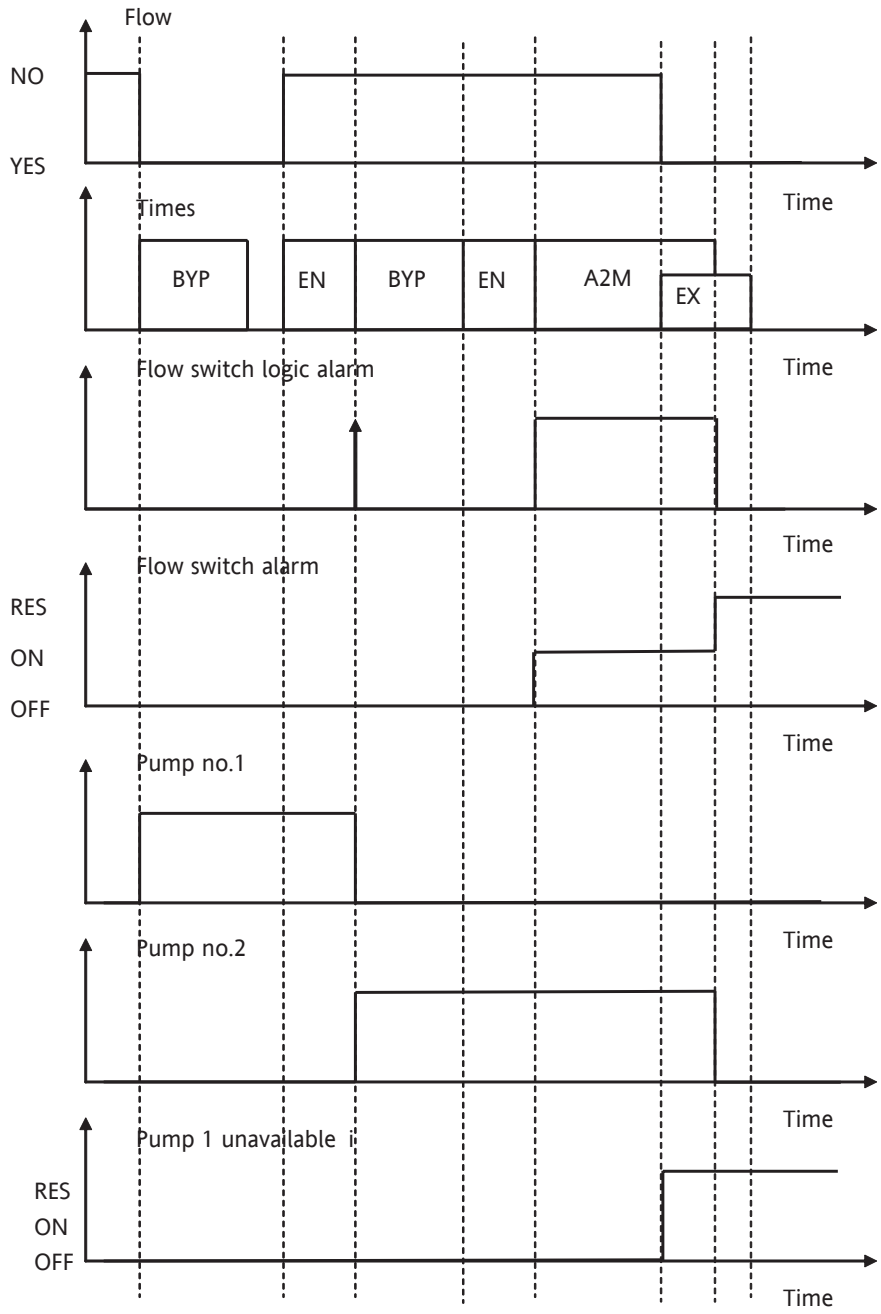
Flow	PUMP_A_FLOW_DI_PHY
Pump 1	PUMP_ACC_DO_1_PHY
Pump 2	PUMP_ACC_DO_2_PHY

Note that when pump 1 goes off, the system is not blocked but pump 2 is activated if available.
Since the second pump ensures the flow, the "Pump 1 not available" alarm is sent but the system continues to function normally. The alarm is reset manually.

This alarm is reset :

- manually;
- by changing from On to Off (using the remote ON/OFF keypad);
- at the next Power On;
- when exiting from 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 when pump 1 goes off, the system is not blocked but pump 2 is activated if available.
Since the 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 is sent (re-settable), and the *flow switch alarm* becomes re-settable

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

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

and the system resumes normal operation.

7.6.5 Related parameters

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of code conversion	Parameter description
460	A_FS_BYPASS_STARTUP_TIME	1...99	30	V	0	Sec	C		Bypass time for *flow switch alarm*
461	A_FS_ENTRY_TIME	0...60	10	V	0	Sec	C		Time for which a physical alarm condition continues in the flow switch before the alarm is treated as Present
462	A_FS_EXIT_TIME	0...60	10	V	0	Sec	C		Time for which a physical non-alarm condition continues in the flow switch before the alarm is treated as Not Present
466	A_FS_AUTOMATIC2MANUAL_TIME	1...60	20	V	0	Sec	C		Time after which a *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 control alarms

7.7.1 Compressor thermal protection alarm

Management of this alarm is enabled by parameter A_KOMP_THER_ENABLE_FLAG ed, and is active if the machine is started in Cold mode or going down and the *compressor* is selected.
The *compressor thermal alarm* is reset manually 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 from configuration mode;

7.7.2 Compressor discharge temperature alarm

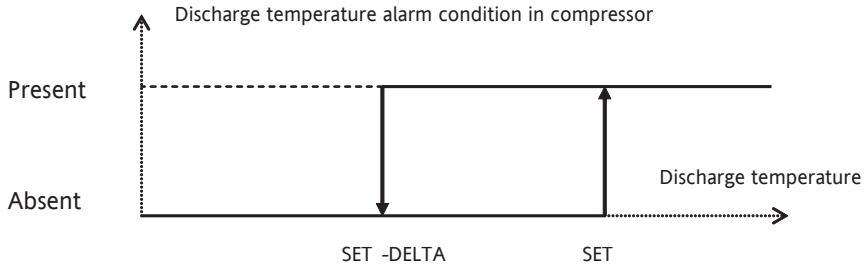


Fig 7.7.2

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

If one of the following conditions is present :

- function disabled (A_DISCHARGE_ENABLE_FLAG =false);
- sensor discharge temperature error;
- system Off;
- *compressor* deselected;

the alarm remains Off.

If none of the above conditions is present, 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 started or going down;
- exit from configuration mode;
- by reset;

7.7.3 Error in compressor discharge temperature sensor

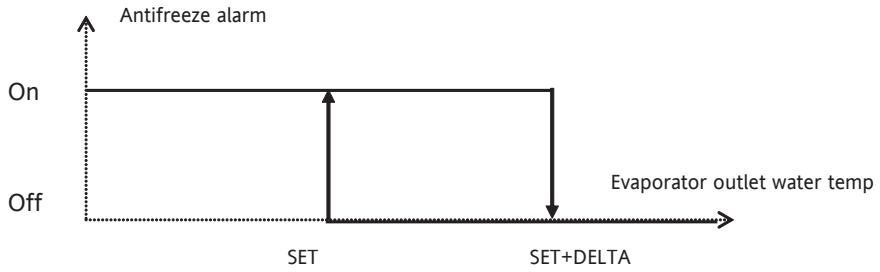
Sensor errors are managed if the *compressor discharge temperature alarm* is enabled, or the liquid injection function is enabled and the *compressor* is selected.
If there is an error in a sensor, the *compressor* associated with that sensor is blocked.

7.7.4 Related parameters

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

Management of the *antifreeze alarm* condition is enabled by the AF_ENABLE_FLAG parameter, irrespective of whether the machine is started in Cold mode, going down, or Off.
The algorithm activates the *antifreeze alarm* by monitoring the outlet temperature of each *evaporator*, according to the hysteresis function where "set" is AF_CH_SET_TEMP/AF_HEATING_SET_TEMP and "delta" is 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 = *evaporator number "i"*

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, when starting in Cold mode, when exiting configuration mode, and after resetting an *antifreeze alarm* condition (when the alarm is reset manually) or an alarm condition in the *evaporator* outlet water sensor.

The alarm is re-armed automatically. If the number of alarm responses in one hour is above the value of parameter MAX_AF_ALARMS_NO, the alarm becomes a manual reset alarm.
When the alarm occurs (an alarm in any one of the evaporators is enough), the system is switched Off and the *antifreeze* heating resistors (in all evaporators) are switched On if parameter AF_USE_RESISTOR_FLAG=yes.

Notice
Switching on the resistors causes a request to activate one of the pumps in the pump group, in order to allow water to circulate in the *primary circuit*.

Alarm management is always re-initialized 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 the system to be blocked (including pump group and *antifreeze* resistors).

7.8.1 Antifreeze sensor errors

Errors in the sensor that monitors the *evaporator* outlet water temperature are managed, with the machine started 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 processed irrespective of the current operating mode of the system.
An error in this sensor causes the system to be blocked (including pump group and *antifreeze* resistors).

7.8.2 Related parameters

Modbus address [hex]	Parameter Category and Name	Range	def	vis	trans	UM	C/H	Description of code conversion	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		Bypass time for *antifreeze alarm*
2B6	AF_HEATING_SET_TEMP	-50.0...150	1.0	V	0	°C	C		*Antifreeze alarm* setpoint in Hot mode
2B7	AF_HEATING_DELTA_TEMP	0.0...10.0	4.0	V	0	°C	C		*Antifreeze alarm* delta in Hot mode
2B8	AF_HEATING_BYPASS_TiME	0...1000	30	V	0	sec	C		*Antifreeze alarm* bypass time in Hot 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 resistors if there is an *antifreeze alarm*

7.9 Management of defrost alarms

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, one of the pumps will not start);
- *evaporator antifreeze* (*alarm*);
- *circuit* and/or *compressor* alarm *that prevents* any of the compressors *in the fan* battery from starting or remaining On;
- fan battery thermal *alarm, the defrost* function always stops, and *remains ready* for immediate restart (DEF_IDLE).

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

Situation 3
In the case of simultaneous *defrost* , if the circuits are already coming out of *defrost* and going down 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 this *circuit*, then this *circuit* goes immediately into the drip phase (DEF_GOING_DOWN→ DEF_WAIT_DRIP), to while waiting for the last *circuit* to complete
the going down phase.
If it is not a simultaneous *defrost* and there is an alarm in one of the *circuits* , or an alarm in all the compressors connected to that *circuit* , then 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.	Reset
04F0	PlanHTempA	High temperature in heat regulation	Blocks the system	Analog	PLANT	1	Manual
04F1	PlantLTempA	Low temperature in heat regulation	Blocks the system	Analog	PLANT	1	Manual
04F2	EvAfA	*Evaporator antifreeze*	Blocks the system and starts the pump if resistors are enabled	Analog	EV	2	Event bounded
0513	KompDisA	*Compressor discharge temperature*	Blocks the *compressor*	Analog	KOMP	8	Manual
04F3	CirHPrA	*Circuit* maximum pressure	Blocks the *circuit*	Analog+ Digital	CIR	8	Manual
04FB	CirLPrA	*Circuit* minimum *pressure*	Blocks the *circuit*	Digital	CIR	8	Event bounded
050B	KompTherA	*Compressor thermal protection*	Blocks the *compressor*	Digital	KOMP	8	Manual
051B	FansTherA	Fan group thermal *alarm*	Blocks the circuits	Digital	FANGROUP	2	Manual
051D	FlowA	Primary flow switch	Blocks the system	Digital	PUMPGROUP	1	Time bounded
051E	PumpTherA	Pump thermal protection	Blocks the pump	Digital	PUMP	2	Manual
0520	PumpUnavailableA	Pump not available	Makes the pump unavailable	Log	PUMP	2	Manual
0502	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

7.11 Errors Table

MODBUS (HEX)	Name	List of sensor errors in BaseLine machine	Input	System	Num.	Action	Reset
0522	PlanTempInWaterSensErr	Heat regulation inlet sensor error	Ana	PLANT	1	Blocks the system	Automatic
0523	PlanTempOutWaterSensErr	Heat regulation outlet sensor error	Ana	PLANT	1	Blocks the system	Automatic
0525	EvTempOutWaterSensErr	*Antifreeze* sensor *error*	Ana	EV	2	Blocks the system	Automatic
0527	CirPresMaxSensErr	*Circuit* maximum pressure sensor *error*	Ana	CIR	8	Blocks the *circuit*	Automatic
052F	KompTempDischargeSensErr	*Compressor* discharge temperature sensor *error*	Ana	KOMP	8	Blocks the *compressor*	Automatic
0524	PlanCurrDtsetSensErr	*Dynamic setpoint* sensor error	Ana	PLANT	1	Disconnects dynamic regulation	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 be able to go into configuration mode, the machine has to be in Off mode.

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	Structural								
200	KOMP_CIR_EV_1	Associate *compressor* 1 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	11...24	11	0	C	V		num
201	KOMP_CIR_EV_2	Associate *compressor* 2 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	12	0	C	V		num
202	KOMP_CIR_EV_3	Associate *compressor* 3 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	21	0	C	V		num
203	KOMP_CIR_EV_4	Associate *compressor* 4 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	22	0	C	V		num
204	KOMP_CIR_EV_5	Associate *compressor* 5 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
205	KOMP_CIR_EV_6	Associate *compressor* 6 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
206	KOMP_CIR_EV_7	Associate *compressor* 7 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
207	KOMP_CIR_EV_8	Associate *compressor* 8 with *circuit* UNIT VALUE of *evaporator* UNIT PLUS TEN	0...24	0	0	C	V		num
208	CIR_*FANS*_1	Associate *circuit* 1 with the fan group indicated	1...2	1	0	C	V		num
209	CIR_*FANS*_2	Associate *circuit* 2 with the fan group indicated	0...2	1	0	C	V		num
20A	CIR_*FANS*_3	Associate *circuit* 3 with the fan group indicated	0...2	2	0	C	V		num
20B	CIR_*FANS*_4	Associate *circuit* 4 with the fan group indicated	0...2	2	0	C	V		num
20C	CIR_*FANS*_5	Associate *circuit* 5 with the fan group indicated	0...2	0	0	C	V		num
20D	CIR_*FANS*_6	Associate *circuit* 6 with the fan group indicated	0...2	0	0	C	V		num
20E	CIR_*FANS*_7	Associate *circuit* 7 with the fan group indicated	0...2	0	0	C	V		num
20F	CIR_*FANS*_8	Associate *circuit* 8 with the fan group indicated	0...2	0	0	C	V		num
210	KOMP_STAGE_1	Number of *power stages* of *compressor* 1	0...3	2	0	C	V		num
211	KOMP_STAGE_2	Number of *power stages* of *compressor* 2	0...3	2	0	C	V		num
212	KOMP_STAGE_3	Number of *power stages* of *compressor* 3	0...3	2	0	C	V		num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
213	KOMP_STAGE_4	Number of *power stages* of *compressor* 4	0...3	2	0	C	V		num
214	KOMP_STAGE_5	Number of *power stages* of *compressor* 5	0...3	2	0	C	V		num
215	KOMP_STAGE_6	Number of *power stages* of *compressor* 6	0...3	2	0	C	V		num
216	KOMP_STAGE_7	Number of *power stages* of *compressor* 7	0...3	2	0	C	V		num
217	KOMP_STAGE_8	Number of *power stages* of *compressor* 8	0...3	2	0	C	V		num
218	KOMP_TYPE	*Compressor type*. Affects the way in which the activation/deactivation sequence is applied to the relays associated with the *power stages* of the compressors	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 output (YES). Changes the order of activation / deactivation of the fan relays	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
222	PUMPS_NO	Number of pumps in the system	1...2	2	0	C	V		num
223	PLAN_MODE_DI_ENABLE_FLAG	Enable mode setting by digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
224	PLAN_ONOFF_DI_ENABLE_FLAG	Enable remote ON-OFF from a digital input	0...1	1	6	C	V	0=NO, 1=YES	flag
	High Level								
240	EV_SELECTION_FUNCTION	Sets the selection policy for refrigeration power resources at *evaporator* level	0...1	1	28	C	V	0=SATURATION, 1=BALANCING	flag
241	CIR_SELECTION_FUNCTION	Sets the selection policy for refrigeration power resources at *circuit* level	0...1	1	29	C	V	0=SATURATION, 1=BALANCING	flag
242	KOMP_SELECTION_FUNCTION	Sets the selection policy for refrigeration power 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 inlet water temperature on the primary *circuit*)	0...1	1	6	C	V	0=NO, 1=YES	flag

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
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	Bypass time for system *high temperature alarm*	1...99	15	0	H	V		min
246	A_LOWT_ENABLE_FLAG	Enable system *low temperature alarm* (the alarm monitors the inlet water temperature on the primary *circuit*)	0...1	1	6	C	V	0=NO, 1=YES	Flag
247	A_LOWT_THRESHOLD_TEMP_HOT	Set point for system *low temperature alarm*	-15.0...50.0	30.0	0	H	V		°C
248	A_LOWT_BYPASS_TIME_HOT	Bypass time for system *low temperature alarm*	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* start-ups	0...10	2	0	H	V		sec
	Configuration of heat regulation								
260	TREG_FUNCTION	Heat regulation type 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 heat regulation	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. heat regulator.	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. heat regulator.	1...900	600	0	H	V		sec
264	PI_PROP_COMPONENT_FLAG_HOT	User flag for proportional component of P.I. heat regulator.	0...1	1	6	H	V	0=NO, 1=YES	flag
	Chiller heat regulation								
270	CH_TSET_TEMP_HOT	Cold setpoint	CH_MIN_TSET_TEMP.... CH_MAX_TSET_TEMP	7.0	0	H	V		°C
271	CH_MIN_TSET_TEMP	Minimum value of cold setpoint	-50.0...80.0	5.0	0	C	V		°C
272	CH_MAX_TSET_TEMP	Maximum value of cold setpoint	-50.0...80.0	25.0	0	C	V		°C
273	CH_ENTRY_OFFSET_HOT	Cold setpoint offset if heat regulation is through water inlet temperature sensor of the primary *circuit*	0.0...15.0	0.0	0	H	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
274	CH_PROP_BAND_HOT	Cold proportional band	CH_MIN_PROP_BAND ... CH_MAX_PROP_BAND	5.0	0	H	V		°C
275	CH_MIN_PROP_BAND	Minimum value of cold proportional band	0.0...25.0	0.0	0	C	V		°C
276	CH_MAX_PROP_BAND	Maximum value of cold proportional band	0.0...25.0	20.0	0	C	V		°C
277	CH_INC_STEP_TIME_HOT	Time between upward steps (increments in refrigeration power)	0...300	10	0	H	V		sec
278	CH_DEC_STEP_TIME_HOT	Time between downward steps (decrements in refrigeration power)	0...300	10	0	H	V		sec
	Heat regulation heat pump								
280	HP_TSET_TEMP_HOT	Hot setpoint	HP_MIN_TSET_TEMP ... HP_MAX_TSET_TEMP	40.0	0	H	V		°C
281	HP_MIN_TSET_TEMP	Minimum value of hot setpoint	-50.0...150.0	30.0	0	C	V		°C
282	HP_MAX_TSET_TEMP	Maximum value of hot setpoint	-50.0...150.0	50.0	0	C	V		°C
283	HP_ENTRY_OFFSET_HOT	Offset of hot setpoint if heat regulation is through the water inlet temperature sensor of the primary *circuit*	0.0...15.0	5.0	0	H	V		°C
284	HP_PROP_BAND_HOT	Hot proportional band	HP_MIN_PROP_BAND ... HP_MAX_PROP_BAND	5.0	0	H	V		°C
285	HP_MIN_PROP_BAND	Minimum value of hot proportional band	0.0...150.0	5.0	0	C	V		°C
286	HP_MAX_PROP_BAND	Maximum value of hot proportional band	0.0...150.0	5.0	0	C	V		°C
287	HP_INC_STEP_TIME_HOT	Time between upward steps (power increments) in Hot mode	0...300	10	0	H	V		sec
288	HP_DEC_STEP_TIME_HOT	Time between downward steps (power decrements) in Hot 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 of *dynamic setpoint* from cold setpoint	-30.0...30.0	6.0	0	C	V		°C
2A2	DTSET_HEATPUMP_MAX_OFFSET	Maximum offset of *dynamic setpoint* from hot 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

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
2B1	AF_USE_RESISTOR_FLAG	Enable use of the resistors if there is an *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	Bypass time for *antifreeze alarm*	0...1000	30	0	C	V		sec
2B5	MAX_AF_ALARMS_NO	Maximum number of *antifreeze alarm*s in the hour preceding the *antifreeze alarm* change from automatic to manual	0...1000	0	0	C	V		num
2B6	AF_HEATING_SET_TEMP	*Antifreeze alarm* setpoint in Hot mode	-50.0...150.0	1.0	0	C	V		°C
2B7	AF_HEATING_DELTA_TEMP	*Antifreeze alarm* delta in Hot mode	0.0...10.0	4.0	0	C	V		°C
2B8	AF_HEATING_BYPASS_TIME	Bypass time for *antifreeze alarm* in Hot 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 down (in Cold or Going Down mode)	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 down or heating	0...1	0	6	C	V	0=NO, 1=YES	flag
2C6	AFPR_HEATING_TSET	*Antifreeze prevention* setpoint in Hot mode	-50.0...150.0	5.0	0	C	V		°C
	Circuit								
2E0	A_MAX_PRES	Setpoint for *circuit* maximum pressure alarm	0.0...50.0	28.0	0	C	V		Bar
2E1	A_MAX_DELTA_PRES	Delta for *circuit* maximum pressure alarm	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	Bypass time for minimum pressure alarm	0....500	120	0	H	V		sec
	Compressor								

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
2F0	MIN_OFFON_TIME_HOT	Safety protection time from *compressor* OFF to ON	0...500	60	0	H	V		sec
2F1	MIN_ONOFF_TIME_HOT	Safety protection time from *compressor* ON to OFF	0...500	10	0	H	V		sec
2F2	MAX_STARTS_PER_HOUR_NO_HOT	Maximum number of *compressor* start-ups in one hour	0...20	6	0	H	V		num
2F3	CPWR_UPDOWN_MIN_TIME_HOT	Safety protection time between downward *power stages*	0...30	10	0	H	V		sec
2F4	CPWR_DOWNUP_MIN_TIME_HOT	Safety protection time between upward *power stages*	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	Setpoint for *compressor discharge temperature alarm*	40.0...150.0	125.0	0	C	V		°C
2F7	A_DISCHARGE_DELTA_TEMP	Delta for *compressor discharge temperature alarm*	0.0...30.0	30.0	0	C	V		°C
2F8	A_KOMP_THER_ENABLE_FLAG	Enable *compressor* thermal 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 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
	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	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
	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

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
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* usage time**								
0	KOMP_USAGE_DAYS_1	Days of use of *compressor* 1	0...32000	0	0	C	V		day
1	KOMP_USAGE_DAYS_2	Days of use of *compressor* 2	0...32000	0	0	C	V		day
2	KOMP_USAGE_DAYS_3	Days of use of *compressor* 3	0...32000	0	0	C	V		day
3	KOMP_USAGE_DAYS_4	Days of use of *compressor* 4	0...32000	0	0	C	V		day
4	KOMP_USAGE_DAYS_5	Days of use of *compressor* 5	0....32000	0	0	C	V		day
5	KOMP_USAGE_DAYS_6	Days of use of *compressor* 6	0...32000	0	0	C	V		day
6	KOMP_USAGE_DAYS_7	Days of use of *compressor* 7	0...32000	0	0	C	V		day
7	KOMP_USAGE_DAYS_8	Days of use of *compressor* 8	0...32000	0	0	C	V		day
8	KOMP_USAGE_HOUR_1	Hours of use of *compressor* 1	0...24	0	0	C	V		hour
9	KOMP_USAGE_HOUR_2	Hours of use of *compressor* 2	0...24	0	0	C	V		hour
A	KOMP_USAGE_HOUR_3	Hours of use of *compressor* 3	0...24	0	0	C	V		hour
B	KOMP_USAGE_HOUR_4	Hours of use of *compressor* 4	0...24	0	0	C	V		hour
C	KOMP_USAGE_HOUR_5	Hours of use of *compressor* 5	0...24	0	0	C	V		hour
D	KOMP_USAGE_HOUR_6	Hours of use of *compressor* 6	0...24	0	0	C	V		hour
E	KOMP_USAGE_HOUR_7	Hours of use of *compressor* 7	0...24	0	0	C	V		hour
F	KOMP_USAGE_HOUR_8	Hours of use of *compressor* 8	0...24	0	0	C	V		hour
	Configuration of fan regulator								

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
340	*FANS*_KOMP_DEPENDENCY_FLAG	If set to NO, the *fans* in the batteries operate independently of the status of the compressors belonging to the circuits in which the batteries are controlling the condensation, otherwise at least one of these compressors must be On so that fan *control* can be actuated for the batteries.	0...1	1	6	C	V	0=NO, 1=YES	flag
341	*FANS*_CH_INIT_MAX_POWER_TIME	Time during which the *fans* in the batteries are operating at full power% each time the battery is started in Cold mode	0...120	60	0	C	V		sec
342	*FANS*_HP_INIT_MAX_POWER_TIME	Time during which the *fans* in the batteries are operating at full power% each time the battery is started in Hot mode	0...120	60	0	C	V		sec
343	*FANS_CONTROL*_FUNCTION	Selects the type of fan *control* and actuation	0...1	0	31	C	V	0=CONT, 1=DIGITAL	flag
344	CUTOFF_CH_ENABLED_FLAG	Enable CUTOFF for chiller	0...1	1	6	C	V	0=NO, 1=YES	flag
345	CUTOFF_HP_ENABLED_FLAG	Enable CUTOFF for heat pump	0...1	1	6	C	V	0=NO, 1=YES	flag
346	*FANS_CONTROL*_INPUT_SOURCE	Sensor used for *condensation control*	0...1	1	24	C	V	0=temperature 1=pressure	num
	Digital fan regulator in Chiller								
360	*FANS*_CSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in Cold mode	0.0...50.0	13.0	0	C	V		Bar
361	*FANS*_CSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in Cold mode	0.0...50.0	15.0	0	C	V		Bar
362	*FANS*_CSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in Cold mode	0.0...50.0	17.0	0	C	V		Bar
363	*FANS*_CSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in Cold mode	0.0...50.0	19.0	0	C	V		Bar
364	*FANS*_CSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in Cold mode	0.0...50.0	0.0	0	C	V		Bar
365	*FANS*_CSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in Cold mode	0.0...50.0	0.0	0	C	V		Bar
366	*FANS*_CSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in Cold mode	0.0...50.0	0.0	0	C	V		Bar
367	*FANS*_CSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in Cold mode	0.0...50.0	0.0	0	C	V		Bar
368	*FANS*_CSTOP_DELTA1_PRES	Delta pressure for deactivating ventilation step 1 in Cold mode	0.0...10.0	2.0	0	C	V		Bar
369	*FANS*_CSTOP_DELTA2_PRES	Delta pressure for deactivating ventilation step 2 in Cold mode	0.0...10.0	2.0	0	C	V		Bar
36A	*FANS*_CSTOP_DELTA3_PRES	Delta pressure for deactivating ventilation step 3 in Cold mode	0.0...10.0	2.0	0	C	V		Bar
36B	*FANS*_CSTOP_DELTA4_PRES	Delta pressure for deactivating ventilation step 4 in Cold mode	0.0...10.0	2.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
36C	*FANS*_CSTOP_DELTA5_PRES	Delta pressure for deactivating ventilation step 5 in Cold mode	0.0...10.0	0.0	0	C	V		Bar
36D	*FANS*_CSTOP_DELTA6_PRES	Delta pressure for deactivating ventilation step 6 in Cold mode	0.0...10.0	0.0	0	C	V		Bar
36E	*FANS*_CSTOP_DELTA7_PRES	Delta pressure for deactivating ventilation step 7 in Cold mode	0.0...10.0	0.0	0	C	V		Bar
36F	*FANS*_CSTOP_DELTA8_PRES	Delta pressure for deactivating ventilation step 8 in Cold mode	0.0...10.0	0.0	0	C	V		Bar
370	*FANS*_CSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in Cold mode	-50.0....150.0	18.0	0	C	V		°C
371	*FANS*_CSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in Cold mode	-50.0....150.0	25.0	0	C	V		°C
372	*FANS*_CSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in Cold mode	-50.0...150.0	35.0	0	C	V		°C
373	*FANS*_CSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in Cold mode	-50.0....150.0	40.0	0	C	V		°C
374	*FANS*_CSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in Cold mode	-50.0...150.0	0.0	0	C	V		°C
375	*FANS*_CSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in Cold mode	-50.0....150.0	0.0	0	C	V		°C
376	*FANS*_CSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in Cold mode	-50.0....150.0	0.0	0	C	V		°C
377	*FANS*_CSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in Cold mode	-50.0...150.0	0.0	0	C	V		°C
378	*FANS*_CSTOP_DELTA1_TEMP	Delta temperature for deactivating ventilation step 1 in Cold mode	0.0....25.5	2.0	0	C	V		°C
379	*FANS*_CSTOP_DELTA2_TEMP	Delta temperature for deactivating ventilation step 2 in Cold mode	0.0...25.5	2.0	0	C	V		°C
37A	*FANS*_CSTOP_DELTA3_TEMP	Delta temperature for deactivating ventilation step 3 in Cold mode	0.0...25.5	2.0	0	C	V		°C
37B	*FANS*_CSTOP_DELTA4_TEMP	Delta temperature for deactivating ventilation step 4 in Cold mode	0.0...25.5	2.0	0	C	V		°C
37C	*FANS*_CSTOP_DELTA5_TEMP	Delta temperature for deactivating ventilation step 5 in Cold mode	0.0...25.5	0.0	0	C	V		°C
37D	*FANS*_CSTOP_DELTA6_TEMP	Delta temperature for deactivating ventilation step 6 in Cold mode	0.0...25.5	0.0	0	C	V		°C
37E	*FANS*_CSTOP_DELTA7_TEMP	Delta temperature for deactivating ventilation step 7 in Cold mode	0.0...25.5	0.0	0	C	V		°C
37F	*FANS*_CSTOP_DELTA8_TEMP	Delta temperature for deactivating ventilation step 8 in Cold mode	0.0...25.5	0.0	0	C	V		°C
	Continuous fan regulator in chiller mode								
3A0	*FANS*_CH_MIN_ON_TIME	Minimum On time for ventilation in chiller mode at minimum speed at least	0...120	30	0	C	V		sec
3A1	CUTOFF_CH_SETPOINT1_PRES	Pressure value under which the CUTOFF switches off chiller mode ventilation	0.0...60.0	8.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
3A2	CUTOFF_CH_DELTA1_PRES	Pressure value to be added to a CUTOFF_CH_SETPOINT1_PRES. If the ventilation *control* pressure goes above the total, the ON/OFF *control* (due to CUTOFF at minimum) becomes 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 is expressed as a percentage, and 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 up 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 the minimum fan speed in chiller mode	0...100	20	0	C	V		%
3A6	*FANS*_CH_MAX_SPEED	Percentage value of the maximum fan 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 goes above 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 the maximum fan speed in chiller mode	0...100	90	0	C	V		%
3AA	CUTOFF_CH_SETPOINT1_TEMP	Temperature value under 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 goes above this total, the ON/OFF *control* (due to CUTOFF at minimum) changes 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 is expressed as a percentage, and 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 up 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 goes above the total, the fan speed will be equal to the value of parameter *FANS*_CH_SAT_SPEED.	0.0...25.5	1.0	0	C	V		°C
	Digital fan regulator in heat pump								
3C0	*FANS*_HSTART_SET1_PRES	Pressure setpoint for activating ventilation step 1 in Hot mode	0.0...50.0	12.0	0	C	V		Bar
3C1	*FANS*_HSTART_SET2_PRES	Pressure setpoint for activating ventilation step 2 in Hot mode	0.0...50.0	10.0	0	C	V		Bar
3C2	*FANS*_HSTART_SET3_PRES	Pressure setpoint for activating ventilation step 3 in Hot mode	0.0...50.0	8.0	0	C	V		Bar
3C3	*FANS*_HSTART_SET4_PRES	Pressure setpoint for activating ventilation step 4 in Hot mode	0.0...50.0	6.0	0	C	V		Bar

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
3C4	*FANS*_HSTART_SET5_PRES	Pressure setpoint for activating ventilation step 5 in Hot mode	0.0...50.0	0.0	0	C	V		Bar
3C5	*FANS*_HSTART_SET6_PRES	Pressure setpoint for activating ventilation step 6 in Hot mode	0.0...50.0	0.0	0	C	V		Bar
3C6	*FANS*_HSTART_SET7_PRES	Pressure setpoint for activating ventilation step 7 in Hot mode	0.0...50.0	0.0	0	C	V		Bar
3C7	*FANS*_HSTART_SET8_PRES	Pressure setpoint for activating ventilation step 8 in Hot mode	0.0...50.0	0.0	0	C	V		Bar
3C8	*FANS*_HSTOP_DELTA1_PRES	Delta pressure for deactivating ventilation step 1 in Hot mode	0.0...10.0	2.0	0	C	V		Bar
3C9	*FANS*_HSTOP_DELTA2_PRES	Delta pressure for deactivating ventilation step 2 in Hot mode	0.0...10.0	2.0	0	C	V		Bar
3CA	*FANS*_HSTOP_DELTA3_PRES	Delta pressure for deactivating ventilation step 3 in Hot mode	0.0...10.0	2.0	0	C	V		Bar
3CB	*FANS*_HSTOP_DELTA4_PRES	Delta pressure for deactivating ventilation step 4 in Hot mode	0.0...10.0	2.0	0	C	V		Bar
3CC	*FANS*_HSTOP_DELTA5_PRES	Delta pressure for deactivating ventilation step 5 in Hot mode	0.0...10.0	0.0	0	C	V		Bar
3CD	*FANS*_HSTOP_DELTA6_PRES	Delta pressure for deactivating ventilation step 6 in Hot mode	0.0...10.0	0.0	0	C	V		Bar
3CE	*FANS*_HSTOP_DELTA7_PRES	Delta pressure for deactivating ventilation step 7 in Hot mode	0.0...10.0	0.0	0	C	V		Bar
3CF	*FANS*_HSTOP_DELTA8_PRES	Delta pressure for deactivating ventilation step 8 in Hot mode	0.0...10.0	0.0	0	C	V		Bar
3D0	*FANS*_HSTART_SET1_TEMP	Temperature setpoint for activating ventilation step 1 in Hot mode	-50.0...150.0	40.0	0	C	V		°C
3D1	*FANS*_HSTART_SET2_TEMP	Temperature setpoint for activating ventilation step 2 in Hot mode	-50.0...150.0	35.0	0	C	V		°C
3D2	*FANS*_HSTART_SET3_TEMP	Temperature setpoint for activating ventilation step 3 in Hot mode	-50.0...150.0	25.0	0	C	V		°C
3D3	*FANS*_HSTART_SET4_TEMP	Temperature setpoint for activating ventilation step 4 in Hot mode	-50.0...150.0	18.0	0	C	V		°C
3D4	*FANS*_HSTART_SET5_TEMP	Temperature setpoint for activating ventilation step 5 in Hot mode	-50.0...150.0	0.0	0	C	V		°C
3D5	*FANS*_HSTART_SET6_TEMP	Temperature setpoint for activating ventilation step 6 in Hot mode	-50.0...150.0	0.0	0	C	V		°C
3D6	*FANS*_HSTART_SET7_TEMP	Temperature setpoint for activating ventilation step 7 in Hot mode	-50.0...150.0	0.0	0	C	V		°C
3D7	*FANS*_HSTART_SET8_TEMP	Temperature setpoint for activating ventilation step 8 in Hot mode	-50.0...150.0	0.0	0	C	V		°C
3D8	*FANS*_HSTOP_DELTA1_TEMP	Delta temperature for deactivating ventilation step 1 in Hot mode	0.0...25.5	2.0	0	C	V		°C
3D9	*FANS*_HSTOP_DELTA2_TEMP	Delta temperature for deactivating ventilation step 2 in Hot mode	0.0...25.5	2.0	0	C	V		°C
3DA	*FANS*_HSTOP_DELTA3_TEMP	Delta temperature for deactivating ventilation step 3 in Hot mode	0.0...25.5	2.0	0	C	V		°C
3DB	*FANS*_HSTOP_DELTA4_TEMP	Delta temperature for deactivating ventilation step 4 in Hot mode	0.0...25.5	2.0	0	C	V		°C
3DC	*FANS*_HSTOP_DELTA5_TEMP	Delta temperature for deactivating ventilation step 5 in Hot mode	0.0...25.5	0.0	0	C	V		°C
3DD	*FANS*_HSTOP_DELTA6_TE	Delta temperature for deactivating ventilation step 6 in Hot mode	0.0...25.5	0.0	0	C	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	MP								
3DE	*FANS*_HSTOP_DELTA7_TEMP	Delta temperature for deactivating ventilation step 7 in Hot mode	0.0...25.5	0.0	0	C	V		°C
3DF	*FANS*_HSTOP_DELTA8_TEMP	Delta temperature for deactivating ventilation step 8 in Hot mode	0.0...25.5	0.0	0	C	V		°C
400	*FANS*_HP_MIN_ON_TIME	Minimum On time for ventilation in free cooling at minimum speed at least	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 ON/OFF *control* (due to CUTOFF) becomes 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 is expressed as a percentage, and 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 up 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	Minimum fan speed in pump mode, expressed as a percentage	0...100	40	0	C	V		%
406	*FANS*_HP_MAX_SPEED	Maximum fan speed in pump mode, expressed as a percentage	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	Maximum fan speed in pump mode, expressed as a percentage.	0...100	90	0	C	V		%
40A	CUTOFF_HP_SETPOINT1_TEMP	Temperature value under which the CUTOFF switches off pump mode ventilation	-50.0...150.0	52.0	0	C	V		°C
40B	CUTOFF_HP_DELTA1_TEMP	Temperature value in Hot 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 *control* is started for ventilation in pump mode. The fan speed is expressed as a percentage, and 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 up 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

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
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 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 the drip cycle	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 steps during Energy 400 *defrost*	0....1000	30	0	C	V		Sec
426	DF_INVERSION_TIME	Time interval between - when the *circuit* goes down for defrosting and when the *reverse cycle valve* changes position - when the *reverse cycle valve* changes position and when the *circuit* goes into *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	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	Pressure value at which defrosting stops	0.0...50.0	12.0	0	C	V		Bar
42A	DF_MIN_DURATION_TIME	Minimum time for which defrosting is to continue	0....30	5	0	C	V		Min
42B	DF_MAX_DURATION_TIME	Maximum time for which defrosting is to continue	0...60	30	0	C	V		Min
42C	DF_BYPASS_MIN_TIME	Bypass time for minimum pressure alarms when *defrost* is started	0...30	5	0	C	V		Min
42D	DF_MAX_FANSP_PRES	Pressure value above which the *fans* go up 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_TI	Bypass time for *flow switch alarm*	1...99	30	0	C	V		Sec

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	ME								
461	A_FS_ENTRY_TIME	Time for which the flow switch is left in a physical alarm condition until the alarm is treated as Present	0...60	10	0	C	V		Sec
462	A_FS_EXIT_TIME	Time for which the flow switch is left in a physical non-alarm condition 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 delay between system ON (which causes activation of the selected pump) and the start of heat regulation	0...2000	60	0	C	V		Sec
465	PUMPGROUP_STOP_DELAY_TIME	Time for which the active pump must remain On after there has been 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 usage 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	Selects the pump-down type: not active (NO_PD), at start-up (ON_START), or at start-up and going down (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-up	0...1800	10	0	C	V		Sec
492	PD_ONOFF_MAX_TIME	Maximum pump-down time when going down	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
	Statuses 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								

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	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
6F1	E2_HISTORY_NUM	Number of alarms entered in the *alarms history*. If its value is zero, the history is empty. If its value 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 should not be taken into consideration 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 the value is 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	Delta temperature for activating integrated resistors	-10.0...10.0	2.0	0	H	V		°C
4C2	INTH_PROP_BAND	Proportional band for activating integrated resistors	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 type	0...2	0	0	C	V	0=Daily,1=Weekly, 2=5+2	Num
7F2	TIME_1_BAND1_ENABLE_FLAG	enable time 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 time band 1 LUN/5D/SETT	0...23	0	0	C	V		Hour
7F4	TIME_1_BAND1_MIN	minutes for start of time band 1 LUN/5D/SETT	0...59	0	0	C	V		Min
7F5	TIME_1_BAND1_MODE_HOT	operating mode for time band 1 LUN/5D/SETT	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
7F6	TIME_1_BAND1_CH_TSET_TEMP_HOT	cold mode setpoint for time band 1 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7F7	TIME_1_BAND1_HP_TSET_TEMP_HOT	hot mode setpoint for time band 1 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7F8	TIME_1_BAND2_ENABLE_FLAG	enable time band 2 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7F9	TIME_1_BAND2_HOUR	hours for start of time band 2 LUN/5D/SETT	0...23	6	0	C	V		Hour
7FA	TIME_1_BAND2_MIN	minutes for start of time band 2 LUN/5D/SETT	0...59	0	0	C	V		Min
7FB	TIME_1_BAND2_MODE_HOT	operating mode for time band 2 LUN/5D/SETT	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
7FC	TIME_1_BAND2_CH_TSET_TEMP_HOT	cold mode setpoint for time band 2 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
7FD	TIME_1_BAND2_HP_TSET_TEMP_HOT	hot mode setpoint for time band 2 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
7FE	TIME_1_BAND3_ENABLE_FLAG	enable time band 3 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
7FF	TIME_1_BAND3_HOUR	hours for start of time band 3 LUN/5D/SETT	0...23	12	0	C	V		Hour
800	TIME_1_BAND3_MIN	minutes for start of time band 3 LUN/5D/SETT	0...59	0	0	C	V		Min
801	TIME_1_BAND3_MODE_HOT	operating mode for time band 3 LUN/5D/SETT	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
802	TIME_1_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
803	TIME_1_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C
804	TIME_1_BAND4_ENABLE_FLAG	enable time band 4 LUN/5D/SETT	0...1	1	6	C	V	0=NO, 1=YES	flag
805	TIME_1_BAND4_HOUR	hours for start of time band 4 LUN/5D/SETT	0...23	18	0	C	V		Hour
806	TIME_1_BAND4_MIN	minutes for start of time band 4 LUN/5D/SETT	0...59	0	0	C	V		Min
807	TIME_1_BAND4_MODE_HOT	operating mode for time band 4 LUN/5D/SETT	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
808	TIME_1_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 LUN/5D/SETT	-50.0...150.0	12.0	0	H	V		°C
809	TIME_1_BAND4_HP_TSET_	hot setpoint for time band 4 LUN/5D/SETT	-50.0...150.0	40.0	0	H	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	TEMP_HOT								
80A	TIME_2_BAND1_ENABLE_FLAG	enable time band 1 MAR/2D	0...1	1	6	C	V	0=NO, 1=YES	flag
80B	TIME_2_BAND1_HOUR	hours for start of time band 1 MAR /2D	0...23	0	0	C	V		Hour
80C	TIME_2_BAND1_MIN	minutes for start of time band 1 MAR /2D	0...59	0	0	C	V		Min
80D	TIME_2_BAND1_MODE_HOT	operating mode for time band 1 MAR /2D	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
80E	TIME_2_BAND1_CH_TSET_TEMP_HOT	cold setpoint for time band 1 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
80F	TIME_2_BAND1_HP_TSET_TEMP_HOT	hot setpoint for time band 1 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
810	TIME_2_BAND2_ENABLE_FLAG	enable time band 2 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
811	TIME_2_BAND2_HOUR	hours for start of time band 2 MAR /2D	0...23	6	0	C	V		Hour
812	TIME_2_BAND2_MIN	minutes for start of time band 2 MAR /2D	0...59	0	0	C	V		Min
813	TIME_2_BAND2_MODE_HOT	operating mode for time band 2 MAR /2D	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
814	TIME_2_BAND2_CH_TSET_TEMP_HOT	cold setpoint for time band 2 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
815	TIME_2_BAND2_HP_TSET_TEMP_HOT	hot setpoint for time band 2 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
816	TIME_2_BAND3_ENABLE_FLAG	enable time band 3 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag
817	TIME_2_BAND3_HOUR	hours for start of time band 3 MAR /2D	0...23	12	0	C	V		Hour
818	TIME_2_BAND3_MIN	minutes for start of time band 3 MAR /2D	0...59	0	0	C	V		Min
819	TIME_2_BAND3_MODE_HOT	operating mode for time band 3 MAR /2D	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
81A	TIME_2_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
81B	TIME_2_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
81C	TIME_2_BAND4_ENABLE_FLAG	enable time band 4 MAR /2D	0...1	1	6	C	V	0=NO, 1=YES	flag

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
81D	TIME_2_BAND4_HOUR	hours for start of time band 4 MAR /2D	0...23	18	0	C	V		Hour
81E	TIME_2_BAND4_MIN	minutes for start of time band 4 MAR /2D	0...59	0	0	C	V		Min
81F	TIME_2_BAND4_MODE_HOT	operating mode for time band 4 MAR /2D	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
820	TIME_2_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 MAR /2D	-50.0...150.0	12.0	0	H	V		°C
821	TIME_2_BAND4_HP_TSET_TEMP_HOT	hot setpoint for time band 4 MAR /2D	-50.0...150.0	40.0	0	H	V		°C
822	TIME_3_BAND1_ENABLE_FLAG	enable time band 1 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
823	TIME_3_BAND1_HOUR	hours for start of time band 1 MER	0...23	0	0	C	V		Hour
824	TIME_3_BAND1_MIN	minutes for start of time band 1 MER	0...59	0	0	C	V		Min
825	TIME_3_BAND1_MODE_HOT	operating mode for time band 1 MER	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
826	TIME_3_BAND1_CH_TSET_TEMP_HOT	cold setpoint for time band 1 MER	-50.0...150.0	12.0	0	H	V		°C
827	TIME_3_BAND1_HP_TSET_TEMP_HOT	hot setpoint for time band 1 MER	-50.0...150.0	40.0	0	H	V		°C
828	TIME_3_BAND2_ENABLE_FLAG	enable time band 2 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
829	TIME_3_BAND2_HOUR	hours for start of time band 2 MER	0...23	6	0	C	V		Hour
82A	TIME_3_BAND2_MIN	minutes for start of time band 2 MER	0...59	0	0	C	V		Min
82B	TIME_3_BAND2_MODE_HOT	operating mode for time band 2 MER	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
82C	TIME_3_BAND2_CH_TSET_TEMP_HOT	cold setpoint for time band 2 MER	-50.0...150.0	12.0	0	H	V		°C
82D	TIME_3_BAND2_HP_TSET_TEMP_HOT	hot setpoint for time band 2 MER	-50.0...150.0	40.0	0	H	V		°C
82E	TIME_3_BAND3_ENABLE_FLAG	enable time band 3 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
82F	TIME_3_BAND3_HOUR	hours for start of time band 3 MER	0...23	12	0	C	V		Hour
830	TIME_3_BAND3_MIN	minutes for start of time band 3 MER	0...59	0	0	C	V		Min
831	TIME_3_BAND3_MODE_H	operating mode for time band 3 MER	0...4	0	0	H	V	0=OFF	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
	OT							1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	
832	TIME_3_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 MER	-50.0...150.0	12.0	0	H	V		°C
8	TIME_3_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 MER	-50.0...150.0	40.0	0	H	V		°C
834	TIME_3_BAND4_ENABLE_FLAG	enable time band 4 MER	0...1	1	6	C	V	0=NO, 1=YES	flag
835	TIME_3_BAND4_HOUR	hours for start of time band 4 MER	0...23	18	0	C	V		Hour
836	TIME_3_BAND4_MIN	hours for start of time band 4 MER	0...59	0	0	C	V		Min
837	TIME_3_BAND4_MODE_HOT	operating mode for time band 4 MER	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
838	TIME_3_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 MER	-50.0...150.0	12.0	0	H	V		°C
839	TIME_3_BAND4_HP_TSET_TEMP_HOT	hot setpoint for time band 4 MER	-50.0...150.0	40.0	0	H	V		°C
83A	TIME_4_BAND1_ENABLE_FLAG	enable time band 1 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
83B	TIME_4_BAND1_HOUR	hours for start of time band 1 GIO	0...23	0	0	C	V		Hour
83C	TIME_4_BAND1_MIN	minutes for start of time band 1 GIO	0...59	0	0	C	V		Min
83D	TIME_4_BAND1_MODE_HOT	operating mode for time band 1 GIO	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
83E	TIME_4_BAND1_CH_TSET_TEMP_HOT	cold setpoint for time band 1 GIO	-50.0...150.0	12.0	0	H	V		°C
83F	TIME_4_BAND1_HP_TSET_TEMP_HOT	hot setpoint for time band 1 GIO	-50.0...150.0	40.0	0	H	V		°C
840	TIME_4_BAND2_ENABLE_FLAG	enable time band 2 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
841	TIME_4_BAND2_HOUR	hours for start of time band 2 GIO	0...23	6	0	C	V		Hour
842	TIME_4_BAND2_MIN	minutes for start of time band 2 GIO	0...59	0	0	C	V		Min
843	TIME_4_BAND2_MODE_HOT	operating mode for time band 2 GIO	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL	Num

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
								4=LOCAL SET	
844	TIME_4_BAND2_CH_TSET_TEMP_HOT	cold setpoint for time band 2 GIO	-50.0...150.0	12.0	0	H	V		°C
845	TIME_4_BAND2_HP_TSET_TEMP_HOT	hot setpoint for time band 2 GIO	-50.0...150.0	40.0	0	H	V		°C
846	TIME_4_BAND3_ENABLE_FLAG	enable time band 3 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
847	TIME_4_BAND3_HOUR	hours for start of time band 3 GIO	0...23	12	0	C	V		Hour
848	TIME_4_BAND3_MIN	minutes for start of time band 3 GIO	0...59	0	0	C	V		Min
849	TIME_4_BAND3_MODE_HOT	operating mode for time band 3 GIO	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
84A	TIME_4_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 GIO	-50.0...150.0	12.0	0	H	V		°C
84B	TIME_4_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 GIO	-50.0...150.0	40.0	0	H	V		°C
84C	TIME_4_BAND4_ENABLE_FLAG	enable time band 4 GIO	0...1	1	6	C	V	0=NO, 1=YES	flag
84D	TIME_4_BAND4_HOUR	hours for start of time band 4 GIO	0...23	18	0	C	V		Hour
84E	TIME_4_BAND4_MIN	minutes for start of time band 4 GIO	0...59	0	0	C	V		Min
84F	TIME_4_BAND4_MODE_HOT	operating mode for time band 4 GIO	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
850	TIME_4_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 GIO	-50.0...150.0	12.0	0	H	V		°C
851	TIME_4_BAND4_HP_TSET_TEMP_HOT	hot setpoint for time band 4 GIO	-50.0...150.0	40.0	0	H	V		°C
852	TIME_5_BAND1_ENABLE_FLAG	enable time band 1 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
853	TIME_5_BAND1_HOUR	hours for start of time band 1 VEN	0...23	0	0	C	V		Hour
854	TIME_5_BAND1_MIN	minutes for start of time band 1 VEN	0...59	0	0	C	V		Min
855	TIME_5_BAND1_MODE_HOT	operating mode for time band 1 VEN	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
856	TIME_5_BAND1_CH_TSET_TEMP_HOT	cold setpoint for time band 1 VEN	-50.0...150.0	12.0	0	H	V		°C

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
857	TIME_5_BAND1_HP_TSET_TEMP_HOT	hot setpoint for time band 1 VEN	-50.0...150.0	40.0	0	H	V		°C
858	TIME_5_BAND2_ENABLE_FLAG	enable time band 2 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
859	TIME_5_BAND2_HOUR	hours for start of time band 2 VEN	0...23	6	0	C	V		Hour
85A	TIME_5_BAND2_MIN	minutes for start of time band 2 VEN	0...59	0	0	C	V		Min
85B	TIME_5_BAND2_MODE_HOT	operating mode for time band 2 VEN	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
85C	TIME_5_BAND2_CH_TSET_TEMP_HOT	cold setpoint for time band 2 VEN	-50.0...150.0	12.0	0	H	V		°C
85D	TIME_5_BAND2_HP_TSET_TEMP_HOT	hot setpoint for time band 2 VEN	-50.0...150.0	40.0	0	H	V		°C
85E	TIME_5_BAND3_ENABLE_FLAG	enable time band 3 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
85F	TIME_5_BAND3_HOUR	hours for start of time band 3 VEN	0...23	12	0	C	V		Hour
860	TIME_5_BAND3_MIN	minutes for start of time band 3 VEN	0...59	0	0	C	V		Min
861	TIME_5_BAND3_MODE_HOT	operating mode for time band 3 VEN	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
862	TIME_5_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 VEN	-50.0...150.0	12.0	0	H	V		°C
863	TIME_5_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 VEN	-50.0...150.0	40.0	0	H	V		°C
864	TIME_5_BAND4_ENABLE_FLAG	enable time band 4 VEN	0...1	1	6	C	V	0=NO, 1=YES	flag
865	TIME_5_BAND4_HOUR	hours for start of time band 4 VEN	0...23	18	0	C	V		Hour
866	TIME_5_BAND4_MIN	minutes for start of time band 4 VEN	0...59	0	0	C	V		Min
867	TIME_5_BAND4_MODE_HOT	operating mode for time band 4 VEN	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
868	TIME_5_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 VEN	-50.0...150.0	12.0	0	H	V		°C
869	TIME_5_BAND4_HP_TSET_TEMP_HOT	hot setpoint for time band 4 VEN	-50.0...150.0	40.0	0	H	V		°C
86A	TIME_6_BAND1_ENABLE_F	enable time band 1 SAB	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 code conversion	UM
	LAG							1=YES	
86B	TIME_6_BAND1_HOUR	hours for start of time band 1 SAB	0...23	0	0	C	V		Hour
86C	TIME_6_BAND1_MIN	minutes for start of time band 1 SAB	0...59	0	0	C	V		Min
86D	TIME_6_BAND1_MODE_HOT	operating mode for time band 1 SAB	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
86E	TIME_6_BAND1_CH_TSET_TEMP_HOT	cold setpoint for time band 1 SAB	-50.0...150.0	12.0	0	H	V		°C
86F	TIME_6_BAND1_HP_TSET_TEMP_HOT	hot setpoint for time band 1 SAB	-50.0...150.0	40.0	0	H	V		°C
870	TIME_6_BAND2_ENABLE_FLAG	enable time band 2 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
871	TIME_6_BAND2_HOUR	hours for start of time band 2 SAB	0...23	6	0	C	V		Hour
872	TIME_6_BAND2_MIN	minutes for start of time band 2 SAB	0...59	0	0	C	V		Min
873	TIME_6_BAND2_MODE_HOT	operating mode for time band 2 SAB	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
874	TIME_6_BAND2_CH_TSET_TEMP_HOT	cold setpoint for time band 2 SAB	-50.0...150.0	12.0	0	H	V		°C
875	TIME_6_BAND2_HP_TSET_TEMP_HOT	hot setpoint for time band 2 SAB	-50.0...150.0	40.0	0	H	V		°C
876	TIME_6_BAND3_ENABLE_FLAG	enable time band 3 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
877	TIME_6_BAND3_HOUR	hours for start of time band 3 SAB	0...23	12	0	C	V		Hour
878	TIME_6_BAND3_MIN	minutes for start of time band 3 SAB	0...59	0	0	C	V		Min
879	TIME_6_BAND3_MODE_HOT	operating mode for time band 3 SAB	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
87A	TIME_6_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 SAB	-50.0...150.0	12.0	0	H	V		°C
87B	TIME_6_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 SAB	-50.0...150.0	40.0	0	H	V		°C
87C	TIME_6_BAND4_ENABLE_FLAG	enable time band 4 SAB	0...1	1	6	C	V	0=NO, 1=YES	flag
87D	TIME_6_BAND4_HOUR	hours for start of time band 4 SAB	0...23	18	0	C	V		Hour
87E	TIME_6_BAND4_MIN	minutes for start of time band 4 SAB	0...59	0	0	C	V		Min

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

Modbus address [hex]	Parameter Category and Name	Parameter description	Inf	def	trans	C/H	vis	Description of code conversion	UM
								3=MANUAL 4=LOCAL SET	
892	TIME_7_BAND3_CH_TSET_TEMP_HOT	cold setpoint for time band 3 DOM	-50.0...150.0	12.0	0	H	V		°C
893	TIME_7_BAND3_HP_TSET_TEMP_HOT	hot setpoint for time band 3 DOM	-50.0...150.0	40.0	0	H	V		°C
894	TIME_7_BAND4_ENABLE_FLAG	enable time band 4 DOM	0...1	1	6	C	V	0=NO, 1=YES	flag
895	TIME_7_BAND4_HOUR	hours for start of time band 4 DOM	0...23	18	0	C	V		Hour
896	TIME_7_BAND4_MIN	minutes for start of time band 4 DOM	0...59	0	0	C	V		Min
897	TIME_7_BAND4_MODE_HOT	operating mode for time band 4 DOM	0...4	0	0	H	V	0=OFF 1=PUMP 2=CHILLER 3=MANUAL 4=LOCAL SET	Num
898	TIME_7_BAND4_CH_TSET_TEMP_HOT	cold setpoint for time band 4 DOM	-50.0...150.0	12.0	0	H	V		°C
899	TIME_7_BAND4_HP_TSET_TEMP_HOT	hot setpoint for time band 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		Inlet water temperature of primary *circuit*
PlanTempOutWaterSens_1_UI	5F3	-50.0	150.0	0	°C		Outlet water temperature of primary *circuit*
PlanPowPerc_UI	5F4	0	100	0	%		Percentage power output from system
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

Name	Ind. Modbus [hex]	Inf	Sup	Trans	UM	Description of trans.	Description
KompTempDischargeSens_3_UI	601	-50.0	150.0		°C		*Compressor* 3 discharge temperature
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	%		Percentage power output from *circuit* 1
CirPowPerc_2_UI	608						Percentage power output from *circuit* 2
CirPowPerc_3_UI	609						Percentage power output from *circuit* 3
CirPowPerc_4_UI	60A						Percentage power output from *circuit* 4
CirPowPerc_5_UI	60B						Percentage power output from *circuit* 5
CirPowPerc_6_UI	60C						Percentage power output from *circuit* 6
CirPowPerc_7_UI	60D						Percentage power output from *circuit* 7
CirPowPerc_8_UI	60E						Percentage power output from *circuit* 8
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		Maximum pressure sensor *circuit* 1
CirPresMaxSens_2_UI	618	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 2
CirPresMaxSens_3_UI	619	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 3
CirPresMaxSens_4_UI	61A	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 4
CirPresMaxSens_5_UI	61B	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 5
CirPresMaxSens_6_UI	61C	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 6
CirPresMaxSens_7_UI	61D	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 7
CirPresMaxSens_8_UI	61E	-50.0	150.0		Bar		Maximum pressure sensor *circuit* 8
FansPowPerc_1_UI	61F	0	100	0	%		Percentage power output from fan battery 1
FansPowPerc_2_UI	620	0	100	0	%		Percentage power output from fan battery 2

Name	Ind. Modbus [hex]	Inf	Sup	Trans	UM	Description of trans.	Description
HistoryMessage1_UI	621						20 character string that displays the alarm index / number of alarms 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		Temperature sensor at *circuit* 1 condenser
CirTempCondSens_2_UI	628	-50.0	150.0		°C		Temperature sensor at *circuit* 2 condenser
CirTempCondSens_3_UI	629	-50.0	150.0		°C		Temperature sensor at *circuit* 3 condenser
CirTempCondSens_4_UI	62A	-50.0	150.0		°C		Temperature sensor at *circuit* 4 condenser
CirTempCondSens_5_UI	62B	-50.0	150.0		°C		Temperature sensor at *circuit* 5 condenser
CirTempCondSens_6_UI	62C	-50.0	150.0		°C		Temperature sensor at *circuit* 6 condenser
CirTempCondSens_7_UI	62D	-50.0	150.0		°C		Temperature sensor at *circuit* 7 condenser
CirTempCondSens_8_UI	62E	-50.0	150.0		°C		Temperature sensor at *circuit* 8 condenser
ActiveTimeBandChSet_UI	62F	-50.0	150.0		°C		Cold mode setpoint for current time band
ActiveTimeBandHpSet_UI	630	-50.0	150.0		°C		Hot mode setpoint for current time band

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	Visibility of pump menu items
31	USERDVFUNCTION_1			Pump 2	
32	USERDVFUNCTION_2	VAR_ANA_BIOS_6	382	*Circuit* 1	Visibility of circuits menu items
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	Visibility of *compressor* menu items
41	USERDVFUNCTION_11			*Compressor* 2	

Index	Var. MenuMaker PRO	Var. Dictionary	Mb Add. [hex]	Function	Description
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	
47	USERDVFUNCTION_17			*Compressor* 8	
48	USERDVFUNCTION_18	VAR_ANA_BIOS_7	383	*Fans* battery 1	Visibility of *fans* menu items
49	USERDVFUNCTION_19			*Fans* battery 2	
50	USERDVFUNCTION_20			Cold mode	Delta visibility in Cold mode
51	USERDVFUNCTION_21			Hot mode	Delta visibility in Hot mode
52	USERDVFUNCTION_22			Storage. Condenser	Visibility of condenser temperature sensor
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			Cold setpoint parameter	Visibility of Cold mode setpoint CH_TSET_TEMP_HOT
57	USERDVFUNCTION_27			Hot setpoint parameter	Visibility of Hot setpoint item HP_TSET_TEMP_HOT
58	USERDVFUNCTION_28			Cold setpoint time band	Visibility of Cold setpoint for current time band
59	USERDVFUNCTION_29			Hot setpoint time band	Visibility of Hot setpoint for current time band
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

Index	Var. MenuMaker PRO	Var. Dictionary	Mb Add. [hex]	Function
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 the alarm history
22	USER FUNCTION 13	VAR_BOO_BIOS_39	162	Delete blackbox files

9.4 I/O map

The tables below 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 *antifreeze* heater *evaporator* 1
NO3	EV_HEATER_DO_2_PHY	Primary *antifreeze* heater *evaporator* 2
NO4	KOMP_ACC_DO_1_PHY	Start-ups *compressor* 1
NO5	KOMP_ACC_DO_2_PHY	Start-ups *compressor* 2
NO6	KOMP_ACC_DO_3_PHY	Start-ups *compressor* 3
NO7	KOMP_ACC_DO_4_PHY	Start-ups *compressor* 4
NO8	KOMP_PW_DO_1_PHY	Part winding *compressor* 1
NO9	KOMP_PW_DO_2_PHY	Part winding *compressor* 2
NO10	KOMP_PW_DO_3_PHY	Part winding *compressor* 3
NO11	KOMP_PW_DO_4_PHY	Part winding *compressor* 4
NO12	KOMP_PARZ1_DO_1_PHY	Power stage 1 of *compressor* 1
NO13	KOMP_PARZ2_DO_1_PHY	Power stage 2 of *compressor* 1
NO14	KOMP_PARZ1_DO_2_PHY	Power stage 1 of *compressor* 2
NO15	KOMP_PARZ2_DO_2_PHY	Power stage 2 of *compressor* 2
NO17	KOMP_PARZ1_DO_3_PHY	Power stage 1 of *compressor* 3
NO18	KOMP_PARZ2_DO_3_PHY	Power stage 2 of *compressor* 3
NO18	KOMP_PARZ1_DO_4_PHY	Power stage 1 of *compressor* 4
NO19	KOMP_PARZ2_DO_4_PHY	Power stage 2 of *compressor* 4
NO20	PUMP_ACC_DO_1_PHY	Primary water *circuit* pumps
AI1	PLAN_TEMP_INWATER_SENS_PHY	Inlet water temperature sensor of primary *circuit*
AI2	EV_TEMP_OUTWATER_SENS_1_PHY	Primary outlet water temperature sensor *evaporator* 1
AI3	EV_TEMP_OUTWATER_SENS_2_PHY	Primary outlet water temperature sensor *evaporator* 2
AI4	PLAN_TEMP_OUTWATER_SENS_PHY	Primary outlet water common temperature sensor
AI5	CIR_PRES_MAX_SENS_1_PHY	Maximum pressure analog sensor *circuit* 1
AI6	CIR_PRES_MAX_SENS_2_PHY	Maximum pressure analog sensor *circuit* 2
AI7	CIR_PRES_MAX_SENS_3_PHY	Maximum pressure analog sensor *circuit* 3
AI8	CIR_PRES_MAX_SENS_4_PHY	Maximum pressure analog sensor *circuit* 4
AI9	PLAN_CURR_DTSET_SENS_PHY	Current sensor for dynamic Tset
AI13	KOMP_TEMP_DISCHARGE_SENS_1_PHY	Discharge temperature analog sensor *compressor* 1
AI14	KOMP_TEMP_DISCHARGE_SENS_2_PHY	Discharge temperature analog sensor *compressor* 2
AI15	KOMP_TEMP_DISCHARGE_SENS_3_PHY	Discharge temperature analog sensor *compressor* 3
AI16	KOMP_TEMP_DISCHARGE_SENS_4_PHY	Discharge temperature analog sensor *compressor* 4
IDL1	CIR_PRES_MAX_DI_1_PHY	Maximum pressure switch *circuit* 1
IDL2	CIR_PRES_MAX_DI_2_PHY	Maximum pressure switch *circuit* 2
IDL3	CIR_PRES_MAX_DI_3_PHY	Maximum pressure switch *circuit* 3
IDL4	CIR_PRES_MAX_DI_4_PHY	Maximum pressure switch *circuit* 4
IDL5	CIR_PRES_MIN_DI_1_PHY	Minimum pressure switch *circuit* 1
IDL6	CIR_PRES_MIN_DI_2_PHY	Minimum pressure switch *circuit* 2
IDL7	CIR_PRES_MIN_DI_3_PHY	Minimum pressure switch *circuit* 3

IDL8	CIR_PRES_MIN_DI_4_PHY	Minimum pressure switch *circuit* 4
IDL9	KOMP_A_THER_DI_1_PHY	Digital temperature input *compressor* motor 1
IDL10	KOMP_A_THER_DI_2_PHY	Digital temperature input *compressor* motor 2
IDL11	KOMP_A_THER_DI_3_PHY	Digital temperature input *compressor* motor 3
IDL12	KOMP_A_THER_DI_4_PHY	Digital temperature input *compressor* motor 4
IDL13	PUMP_A_FLOW_DI_PHY	Primary *circuit* flow switch
IDL14	*FANS*_A_THER_DI_1_PHY	Thermal alarm fan battery 1
IDL15	*FANS*_A_THER_DI_2_PHY	Thermal alarm fan battery 2
IDL16	PLAN_ON_DI_PHY	Remote On/Off
IDL17	PUMP_A_THER_DI_1_PHY	Primary *circuit* thermal alarm pump 1
IDL18	PUMP_A_THER_DI_2_PHY	Primary *circuit* thermal alarm pump 2
IDL19	PLAN_MODE_DI_PHY	Summer/winter mode switching
AO1	*FANS*_CTRL_AO_1_PHY	Speed *control* for analog fan associated with fan battery 1
AO2	*FANS*_CTRL_AO_2_PHY	Speed *control* for analog fan associated with fan battery 2

9.4.2 XTEH (address 1)

NO1	PUMP_ACC_DO_2_PHY	Primary water *circuit* pumps
NO2	KOMP_IL_DO_1_PHY	Liquid injection *compressor* 1
NO3	KOMP_IL_DO_2_PHY	Liquid injection *compressor* 2
NO4	KOMP_IL_DO_3_PHY	Liquid injection *compressor* 3
NO5	KOMP_IL_DO_4_PHY	Liquid injection *compressor* 4
NO6	CIR_SOLENOID_VALVE_DO_1_PHY	Solenoid valve *circuit* 1
NO7	CIR_SOLENOID_VALVE_DO_2_PHY	Solenoid valve *circuit* 2
NO8	CIR_SOLENOID_VALVE_DO_3_PHY	Solenoid valve *circuit* 3
NO9	CIR_SOLENOID_VALVE_DO_4_PHY	Solenoid valve *circuit* 4
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)

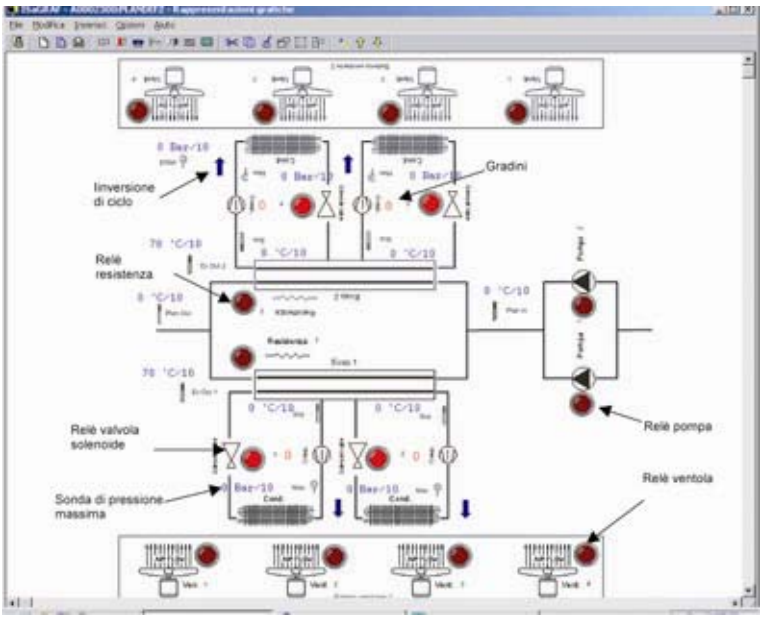
NO1	*FANS*_ACC3_DO_2_PHY	Fan battery 2, start fan 3
NO2	*FANS*_ACC4_DO_2_PHY	Fan battery 2, start fan 4
NO3	KOMP_PARZ3_DO_1_PHY	Stage 3 of *compressor* 1
NO4	KOMP_PARZ3_DO_2_PHY	Stage 3 of *compressor* 2
NO5	KOMP_PARZ3_DO_3_PHY	Stage 3 of *compressor* 3
NO5	KOMP_PARZ3_DO_4_PHY	Stage 3 of *compressor*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

9.5 SpotLight

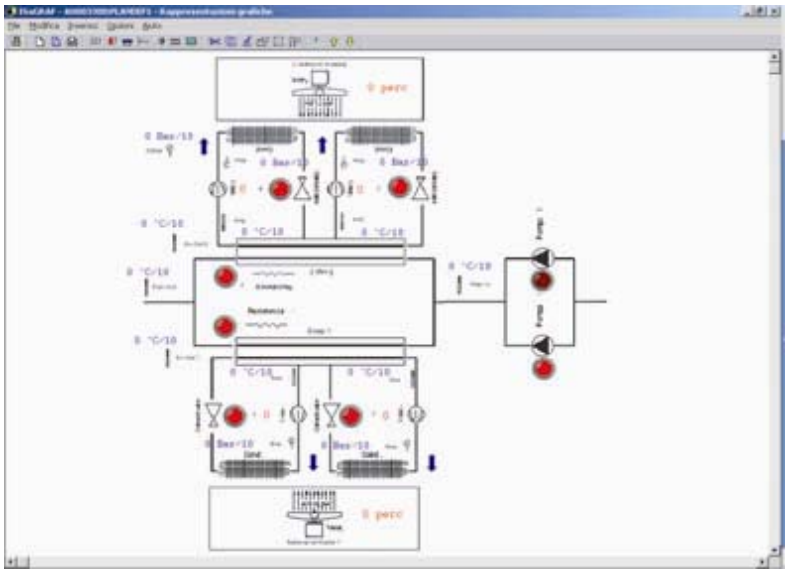
The SpotLiht function in ISaGRAF can be used to activate the PLANDEF and PLANDEF1 mimic panels. These are only used to display:

- Sensor values
- Refrigeration *power stages* for each *compressor*
- Status of solenoid valves
- Status of resistors
- Status of water circulating pumps in primary *circuit*
- Status of *fans* in the two fan batteries
- *Reverse cycle valve* (BLUE arrows for chiller or *defrost* and RED for pump)

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



Picture of PLANDEF1 *spotlight*: default machine with analog *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