



ENERGY XT User Manual



SUMMARY

1	Use of Manual	6
2	Introduction	7
2.1.1	Main components of a circuit	7
2.1.2	Symbols	8
3	User Interface	9
3.1	RapidAccess	12
3.1.1	RapidAccess_CARD_0	12
3.1.2	RapidAccess_CARD_1	12
3.2	Function Menu	13
3.2.1	Function_CARD_0	13
3.3	Menu	13
3.4	Mode Menu	13
3.4.1	CARD_0_Mode	14
3.4.2	CARD_1_Mode	14
3.5	Status Menu	14
3.6	Compressors Menu	14
3.6.1	Compressors_CARD_0	14
3.6.2	Compressors_CARD_1	15
3.6.3	Compressors_CARD_2	15
3.7	Compressor_111	15
3.7.1	Compressor_111_CARD_0	15
3.7.2	Compressor_111_CARD_1	15
3.8	Compressor_211_reset_hours	15
3.9	Compressor_421_reset_hours	16
3.10	Circuits Menu	16
3.10.1	Circuits_CARD_0	16
3.11	Circuits_11	16
3.11.1	Circuits_11_CARD_0	16
3.11.2	Circuits_11_CARD_1	16
3.11.3	Circuits_11_CARD_2	17
3.12	Pump Menu	17
3.13	Alarms Menu	17
3.14	System_Alarms	17
3.15	Alarms_regulation	17
3.16	Alarms_history_list	17
3.17	User_Parameters	18
3.18	Enter_(Cg12) Config Password	18
3.18.1	Enter_(Cg12) Config Password_CARD_0	18
3.19	Time Bands Menu	18
3.20	Time_Bands_Settings	18
3.20.1	Time_Bands_Settings_CARD_0	18
3.20.2	Time_Bands_Settings_CARD_1	19
3.20.3	Time_Bands_Settings_CARD_2	19
3.21	Time_Band_Copy_functions	19
4	System configuration	20
4.1	Type of system	20
4.1.1	Start mode	21
4.1.2	Free cooling pump	22
4.1.3	System: Heat recovery	22
4.1.4	System: Dynamic set point	23
4.2	Evaporator group	24
4.2.1	Selecting the evaporator selection algorithm	25
4.2.2	Temperature sensor	25
4.2.3	Anti-freeze electric heaters	25
4.2.4	Integration electric heaters	25
4.3	Circuits	27
4.3.1	Selecting the circuit selection algorithm	28
4.3.2	Circuits: valves	28
4.3.3	Circuits: Pressure sensors	28
4.3.4	Circuits: Pump Down	29

4.4	Condenser group.....	30
4.4.1	Condenser control.....	31
4.4.2	Condenser defrosting	31
4.5	Single condensing	31
4.6	Fan group.....	34
4.6.1	Active fans with condensation probe alarm	35
4.6.2	Selectable fan thermal switch	35
4.7	Compressors.....	36
4.7.1	Compressors with capacity steps.....	37
4.7.2	Part Winding.....	37
4.7.3	Selecting the compressor selection algorithm	37
4.7.4	Compressor safety.....	37
4.7.5	Compressor swap.....	38
4.7.6	Compressor timing.....	38
4.7.7	Compressor timings with capacity steps	39
4.7.8	Advanced ignition policy	39
4.7.9	Cooling control of the compressor's discharge temperature (liquid injection) -	40
4.7.10	Star/delta start with open transition.....	40
4.8	Pump group.....	42
4.8.1	Control functions of the pump group.....	43
4.8.2	Pump group timing	43
4.8.3	Hydraulic pump not managed directly by the controller.....	44
4.8.4	Pump control: a few examples.....	44
4.8.5	Forcing pumps in test mode.....	44
4.9	Probe configurability.....	44
4.9.1	Probe configuration	45
4.9.2	Probes on compressors.....	49
4.9.3	Probe limitations.....	49
5	Resources' selection policies.....	50
5.1	Saturation.....	50
5.2	Balancing	51
5.3	Compressor selection policies	51
5.3.1	Compressor saturation	51
5.3.2	Compressor balancing.....	51
5.4	Circuit selection policies	51
5.4.1	Circuit saturation.....	52
5.4.2	Circuit balancing.....	52
5.5	Evaporator selection policies	52
5.5.1	Evaporator saturation	52
5.5.2	Evaporator balancing.....	52
5.6	Advanced start policy.....	52
6	Thermoregulation.....	54
6.1	Operating mode	54
6.2	Time bands	54
6.2.1	Time band start time.....	55
6.2.2	Enabling a time band	55
6.2.3	Time band set point.....	55
6.2.4	Time band mode.....	55
6.2.5	Copy Settings function	56
6.3	Temperature control sensors.....	56
6.4	Temperature control in Cooling mode	57
6.5	Temperature control in Heating mode	57
6.6	Temperature control anomalies.....	58
6.7	Types of temperature control	58
6.7.1	Proportional temperature control	58
6.7.2	Time-proportional temperature control.....	60
6.7.3	PI temperature control.....	61
6.8	Dynamic set point.....	61
6.8.1	Dynamic set point with current sensor.....	61
6.8.2	Dynamic set point with temperature sensor.....	62
7	Fans regulator.....	64
7.1	Fans: regulation probes	64

7.2	Fans: activation	64
7.3	Step fan control (digital)	64
7.3.1	Stepping fan control: cooling	65
7.3.2	Stepping fan control: heating	66
7.3.3	Control with fan of equal/different power	68
7.4	Fans control in continuous mode (continuous)	69
7.4.1	Continuous fans control: cooling	70
7.5	Maxpower fans control (on/off)	72
8	Functions	73
8.1	Recording the hours of operation	73
8.2	Defrost	73
8.3	Available defrost functions	73
8.3.1	Defrost enabling conditions	74
8.3.2	Control during defrost	74
8.3.3	Conditions that disable defrost	76
8.4	Dynamic defrost set point	77
8.4.1	Changing the set point with the current sensor	77
8.4.2	Changing the set point with a temperature sensor	78
8.5	Free cooling	79
8.5.1	Free cooling: temperature control	79
8.5.2	Free cooling: enabling	81
8.5.3	Free cooling: disabling	81
8.5.4	Free cooling: condensation pressure	82
8.5.5	Free cooling: circuit control	82
8.6	Pump Down	82
8.6.1	Pump down: probes	83
8.6.2	Pump down: start	83
8.6.3	Pump down: stop	83
8.6.4	Pump down: timing	84
8.6.5	Simplified pump down sequence	85
8.7	Heat recovery	86
8.7.1	Heat recovery : activation	86
8.7.2	Heat recovery : Forcing to chiller without heat recovery	86
9	Diagnostics	88
9.1	Compressor alarms	88
9.1.1	Compressor thermal alarms	88
9.1.2	High discharge temperature alarm	88
9.1.3	Oil differential pressure alarm of compressors	88
9.1.4	Oil pressure switch alarm of compressors	89
9.2	Valve thermal alarms	90
9.3	Minimum pressure alarm of circuits	90
9.4	Maximum pressure alarm of circuits	95
9.5	Evaporator anti-freeze alarm	96
9.5.1	Preventive anti-freeze	97
9.5.2	Evaporator anti-freeze alarm of the secondary circuit	98
9.6	Control of flow switch alarms	98
9.6.1	Water pump thermal alarm	102
9.7	Free cooling pump thermal alarm	103
9.8	Free cooling flow switch alarm	103
9.9	Heat recovery flow switch alarm	103
9.10	Heat recovery pump thermal switch alarm	103
9.11	Unavailable pump alarm	103
9.12	Water pump failure	104
9.12.1	Water pump alarm control	104
9.13	Control failure	104
9.14	High temperature alarm	104
9.15	Low temperature alarm	105
9.16	Automatic circuit alarm	105
9.17	Automatic circuit pump down alarm	105
9.18	Probe errors	106

9.19	Compressor probe error alarm	106
9.20	Anti-freeze probe error alarm.....	106
9.21	Alarm due to heat recovery input temperature probe error.....	106
9.22	Temperature control probe error alarm.....	107
9.23	Free cooling probe error alarm.....	107
10	Water Water Devices	108
10.1	Anti-freeze alarm of the secondary circuit	108
11	Parameters table.....	110
12	Use of the device.....	147
12.1	Permitted Use	147
12.2	Unpermitted Use.....	147
13	Responsibility and residual risks.....	148
14	Disclaimer	149
15	Glossary	150
16	Analitic Index.....	153

1 USE OF 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 INTRODUCTION

The most interesting feature of Energy XT lies in the possibility of flexibly configuring the controller.

The tools provided enable to customize:

- The definition of the unit that has to be controlled (maximum and minimum number of [circuits](#), maximum and minimum number of [compressors](#), number of fans, type of unit, allocation of inputs and outputs...)
- The supported features (Chiller, Recovery and [Free Cooling](#)....)
- The configurations of physical inputs and outputs
- The arrangement of menus

Configuration Wizard

The first two items of the list can be customized with the following tool:

- [XT Configuration Wizard](#)

Apploader

Physical inputs and outputs can be configured with the following tool:

- [Apploader](#)

XT MenuMaker

Menus can be customized with the following tool:

- [XT MenuMaker](#)

For further information, see the related user's manuals.



From a functional point of view it is possible to control systems like chillers and heat pumps (even in reversible configuration) with a series of standard and specific algorithms (recovery, [free cooling](#), [pump down](#), etc.). It is also possible to control a single [type of system](#) with one controller only, i.e. a chiller or heat pump or a reversible heat pump (air-water or water-water).

After defining the base specifications of the controller, it is possible to change some of its characteristics and features through a series of parameters.

Parameters are divided into three main categories: Fixed (F)/ Cold (C)/ Hot (H).

Class F

- **Fixed parameters**

These parameters are generated by the [XT Configuration Wizard](#) and cannot be modified unless the base typology of the controller is changed with a new Wizard session.

Example: the maximum and minimum number of [compressors](#) per circuit is determined by parameter F.

Class C

- **Cold parameters**

These parameters can be changed by the user when the system is not running.

To be able to change [Class C](#) parameters, you need to enable the Configuration mode by selecting the "F4: [Menu/Configuration](#)" [menu](#).

The availability, name and layout of this [menu](#) vary according to how the user has organised the tree view with tool MenuMaker.



The configuration mode can be enabled only if a password has been entered in the "F4: [Menu/Password](#)" [menu](#).

Example: the number of [compressors](#) per circuit (within the specified limits) is determined by parameter C.

Class H

- **Hot parameters**

These parameters can always be changed by the user even when the system is running.

Example: [set points](#) are generally specified by [class H](#) parameters

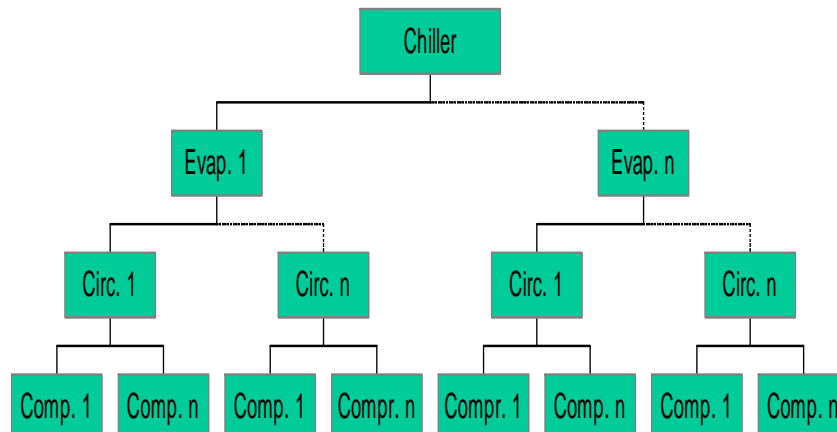
The system parameters – whether fixed, cold or hot – have specific limitations, which guarantee that the combination of parameters selected with the Wizard are compatible with the functional and non functional characteristics of the controllers.

2.1.1 Main components of a circuit

Energy XT divides the main three components of a system in a hierarchy:

- Evaporator
- Circuit
- Compressor

See the following diagram for chiller systems:







The diagrams provided in the manual use the following *symbols* to refer to the main components of the system. In this example, the systems that can be controlled are:

Number of evaporators	Number of <i>circuits</i> per evaporator	Total number of <i>circuits</i>	Number of <i>compressors</i> per circuit	Total number of <i>compressors</i>
1	1	1	1..4	1..4
1	2	2	1..4	2 x 1..4
1	3	3	1..2	3 x 1.0.2
1	4	4	1..2	4 x 1.0.2
2	1	2	1..4	2 x 1..4
2	2	4	1..2	4 x 1.0.2
2	3	6	1	6
2	4	8	1	8
3	1	3	1..2	3 x 1.0.2
3	2	6	1	6
4	1	4	1..2	4 x 1.0.2
4	2	8	1	8

Which means that:

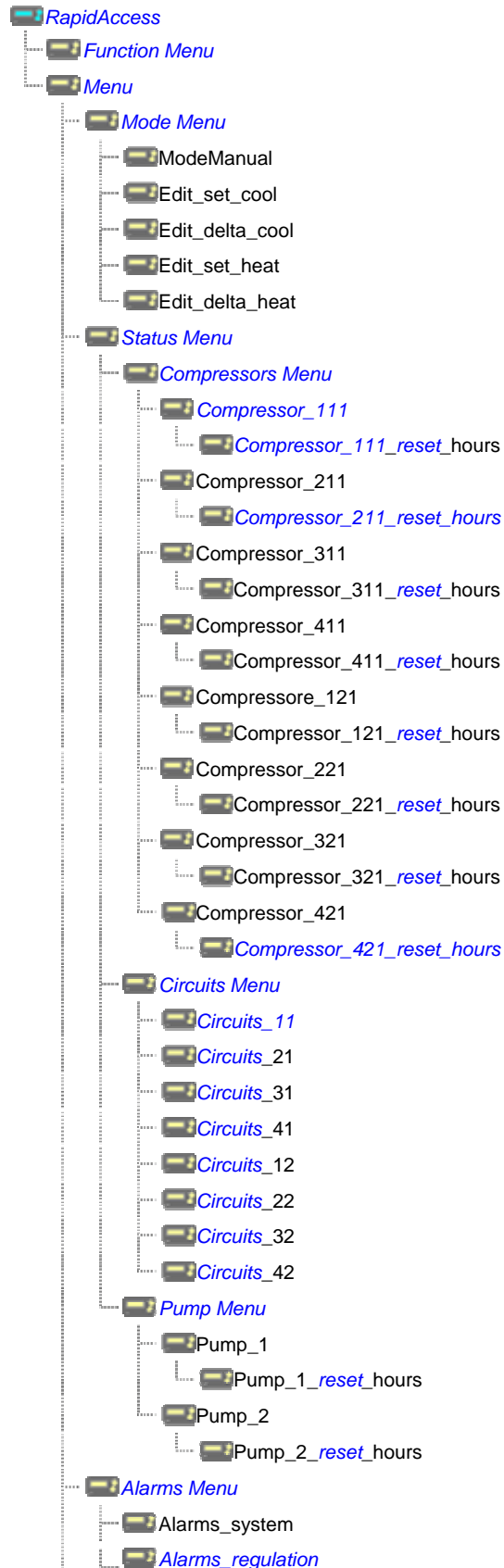
Number of evaporators	Number of <i>circuits</i> per evaporator	Number of <i>compressors</i> per circuit
1	1	1
1	1	2
1	1	3
1	1	4
1	2	1
1	2	2
1	2	3
1	2	4
1	3	1
1	3	2
1	4	1
1	4	2
2	1	1
2	1	2
2	1	3
2	1	4
2	2	1
2	2	2
2	3	1
2	4	1
3	1	1
3	1	2
3	2	1
4	1	1
4	1	2
4	2	1

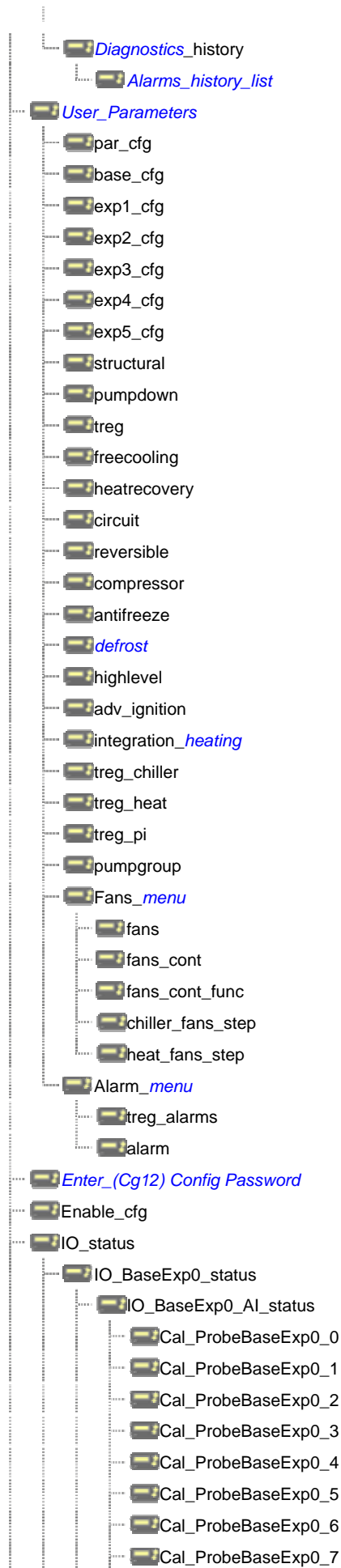
2.1.2 Symbols

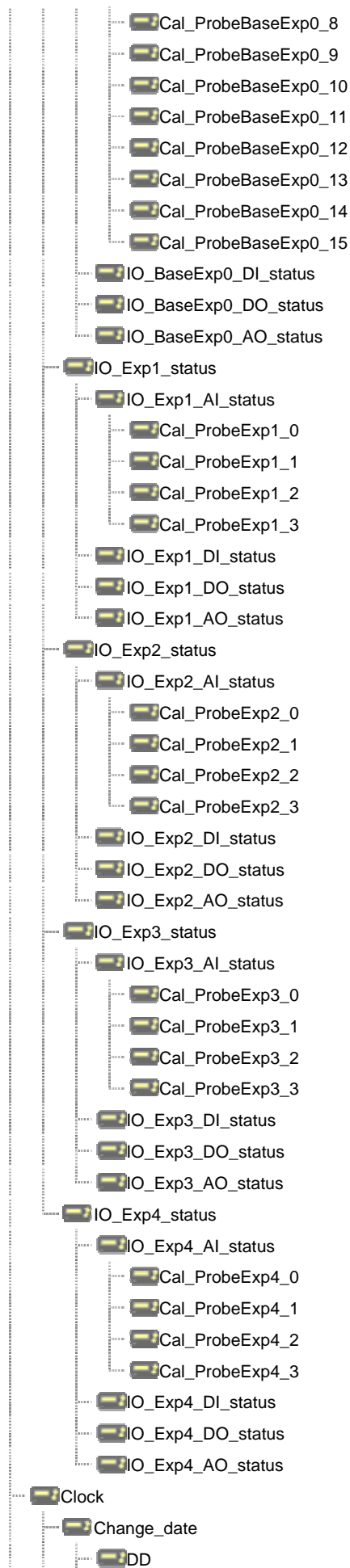
Symbol	Meaning
	Indicates an enabling command related to the device to which it refers.
	Identifies a detection device (the type is specified next to the symbol).
	Specifies the direction of the flow of the thermo-dynamic fluids.
	Indicates a <i>logical OR</i> (which may have more than two inputs).

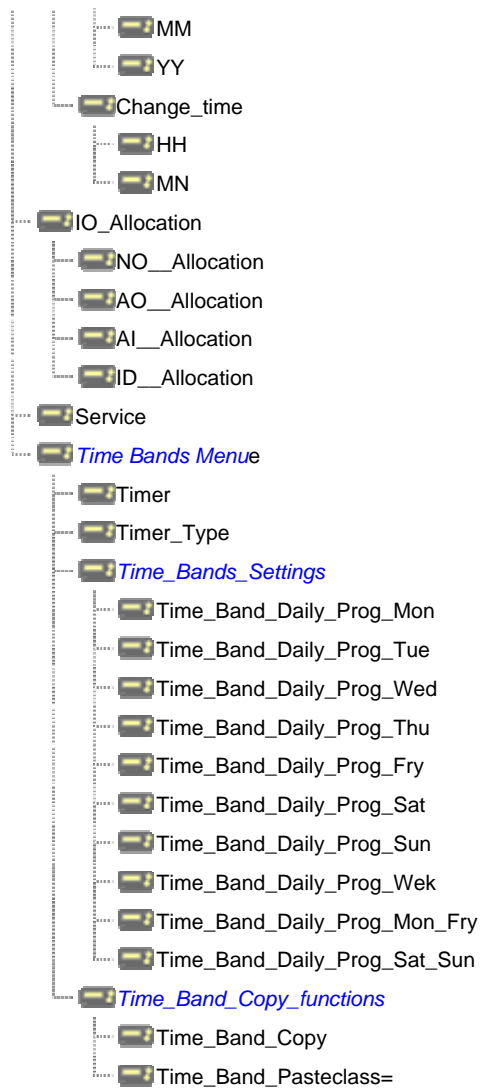
3 USER INTERFACE

This paragraph describes some of the main menus of Energy XT and their *functions*. The tree view shown below refers to a standard unit pre-installed in the controller. However, it is useful to remember that the tree view and typology of menus can be customized by the user with tool XTMenuMaker. Therefore, the actual tree view may differ from the one described. The *user interface* is described in the User's Manual the Energy XY Hardware.









3.1 RapidAccess

This is the screen that displays when Energy XT is switched on. In normal view mode (main view mode), this screen displays:

- Mode
- Set
- Inp. water
- Out. water
- Power %

3.1.1 RapidAccess_CARD_0

Card's view

<i>hh . mm</i>	TITLE	<i>Pg / Pg</i>
xxx		xxx
Set		xxx . c °C
Inp. water		xxx . c °C

- Shutdown mode: the mode with which the unit switches off.
- Current mode: the current *operating mode* of the unit (*HEATING*, *COOLING*, *Standby*). This mode is not affected by the type of manual selection, the time band or the digital input.
- Set: - Set: *set point* value in tenths of °C or °F.
- Inp. water: value of input water in tenths of °C or °F.

3.1.2 RapidAccess_CARD_1

Card's view

<i>hh . mm</i>	TITLE	<i>Pg / Pg</i>
Out . water		xxx . c °C
Power		xxx %
<i>Menu</i>		

- Out. water: value of output water in tenths of °C or °F.
- Power %: power supplied by the unit.
- *Menu*: enables to access the deck *menu* and select other *functions*.

3.2 Function Menu

This *menu* displays every time a function key (F1,F2,F3,F4) is pressed for more than 10 seconds.

This *menu* displays the initial screen of the tree view. The Up and Down keys enable to select the *menu* items. Key Enter enables to access the child *menu*.

3.2.1 Function_CARD_0

Card's view

```

F1: Mode
F2: Status
F3: Alarms
F4: Parameters

```

F1: opens the submenu that enables to control the unit mode (*Heating/Cooling set point...*)

3.3 Menu

This area is accessible from the Main *Menu* or by pressing function key F4.

This is the main exploration *menu*

that enables to access the following submenus :

- Mode
- Status
- Alarms
- Parameters
- I/O Status
- *Time bands*
- Clock
- (*Cg12*) *Config Password*
- Configuration mode
- I/O allocation
- Service

The number and type of displayed I/Os varies according to the type of configured unit.
Some I/Os may not display if some of the *functions* are disabled.

Description of acronyms

ANALOGUE INPUTS

- STIPREn Input temperature probe of main evaporator n
- STISC Input temperature probe of secondary circuit
- STUPREn Output temperature probe of main evaporator n
- STUSC Output temperature probe of secondary circuit
- PRDFnCnEn *Defrost* pressure probe of circuit n evaporator n
- STDFnCnEn *Defrost* temperature probe of evaporator n
- STCnEv Fan control temperature probe of circuit n evaporator n
- STCPRcCnEn Compressor discharge temperature probe

3.4 Mode Menu

This area is accessible from the Main *Menu* or by pressing function key F1.

Displays the current *operating mode* of the unit, regardless of selections: manual, time band or digital input; and enables to change them.

The *menu* also displays and enables to edit the *cooling/heating set points* and deltas.

3.4.1 CARD_0_Mode

Card's view

MODE	Pg/Pg
Mode	xxx
Set cool	xxx.c °C
Delta cool	xxx.c °C

Mode

- HEATING
- COOLING
- OFF

Set cool: initial line of the related submenu. The value on the right represents the current setting.

Delta cool: initial line of the related submenu. The value on the right represents the current setting.

3.4.2 CARD_1_Mode

Card's view

MODE	Pg/Pg
Set heat	xxx.c °C
Delta heat	xxx.c °C

Set Heat: initial line of the related submenu. The value on the right represents the current setting.

Delta Heat: initial line of the related submenu. The value on the right represents the current setting.

3.5 Status Menu

This area is accessible from the Main [Menu](#) or by pressing function key F2.

This area enables to display and edit parameters related to:

- [Compressors](#)
- [Circuits](#)
- Pumps

3.6 Compressors Menu

Displays a summary of the status of each compressor. The number of displayed [compressors](#) varies according to the type of selected unit.

The column on the right displays information on the status of the compressor in function of the position inside the [circuits](#):

- Cxyz: x= Compressor number, y= Circuit number, z= Evaporator number.

Displayed values:

- xx%: The percentage summarizes the number of active capacity steps. 0% indicates that the compressor has been switched off by the temperature control.
- ALARM: if the compressor has been blocked due to an alarm of a single compressor, circuit or unit.
- IDLE: indicates that the user has decided to stop the compressor.
- TIME: indicates that the compressor is counting the safety intervals.
- PUMP-D: indicates that the compressor is in [Pump Down](#) mode.
- [DEFROST](#): indicates that the compressor is in [Defrost](#) mode.

3.6.1 Compressors_CARD_0

Card's view

COMPR	Pg/Pg
C111	xxx
C211	xxx
C311	xxx

Compressor1 - Compressor3

3.6.2 Compressors_CARD_1

Card's view

COMPR	Pg/Pg
C411	xxx
C121	xxx
C221	xxx

Compressor4 - Compressor6

3.6.3 Compressors_CARD_2

Card's view

COMPR	Pg/Pg
C321	xxx
C421	xxx

Compressor7 - Compressor8

3.7 Compressor_111

Displays the status of the compressor.

To enable it, it is sufficient to scroll the list of the previous [menu](#) with keys UP/DOWN of the Joystick [Menu](#) and press Enter on the line of the related compressor.

3.7.1 Compressor_111_CARD_0

Card's view

C111	Pg/Pg
Status	xxx
Hours	xxxxx Hour
Disch. temp.	xxx.x °C

- Status: displays the status of the compressor or the description of the alarm.
- Hours: displays the hours of operation of the compressor.
- Disch. temp.: displays the discharge temperature of the compressor.

3.7.2 Compressor_111_CARD_1

Card's view

C111	Pg/Pg
Oil pres.	xxx.x Bar
Enabl.	xxx

- Enab.: enables or disables the selected compressor.

3.8 Compressor_211_reset_hours

As above

3.9 Compressor_421_reset_hours

.....
As above.

3.10 Circuits Menu

Enables to display the status of [circuits](#). Displays a summary of the status of each circuit.
The number of displayed [circuits](#) varies according to the type of selected unit.

3.10.1 Circuits_CARD_0

Card's view

CIRC.	Pg/Pg
C1	xxx
C2	xxx
C3	xxx

- Status of circuit Cxy: see previous paragraph
- High pressure: value expressed in bars.
- Low pressure: value expressed in bars.
- Ventilation: ventilation percentage of the circuit.
- Enab. (SELECTED/DESELECTED): the enabling/disabling of a circuit causes the enabling/disabling of all the [compressors](#) of the circuit.

3.11 Circuits_11

Status of Circuit 1

3.11.1 Circuits_11_CARD_0

Card's view

CIR 1	Pg/Pg
xxx %	xxx
High Pres.	xxx.x Bar
Low Pres.	xxx.x Bar

Status:

- xx%: the percentage summarizes the number of active steps. 0% indicates that the circuit has been switched off by the temperature control.
- Alarm: if the circuit has been blocked due to an alarm of a single circuit or of the unit
- Off: indicates that the user has decided to stop the circuit
- Pump-d: indicates that the circuit is in [Pump Down](#) mode
- [Defrost](#): indicates that the circuit is in [Defrost](#) mode
- Recovery: indicates that the circuit is in [Heat Recovery](#) mode
- [Free cooling](#): indicates that 100% of the circuit is used for the [Free Cooling](#) mode
- High [cooling](#) pressure : value expressed in bars.
- Low [cooling](#) pressure: value expressed in bars.

3.11.2 Circuits_11_CARD_1

Card's view

CIR 1	Pg/Pg
High Pres.	xxx.x Bar
Low Pres.	xxx.x Bar
Ventilation	xxx %

- High [heating](#) pressure: value expressed in bars.
- Low [heating](#) pressure: value expressed in bars.
- Ventilation: ventilation percentage of the circuit.

3.11.3 Circuits_11_CARD_2

Card's view

CIR 1	Pg/Pg
Enabl .	xxx

- Enab. (SELECTED/DESELECTED): the enabling/disabling of a circuit causes the enabling/disabling of all the [compressors](#) of the circuit.

.

3.12 Pump Menu

Displays the [Pump Menu](#).

It is sufficient to select a pump to access the submenu that displays the running hours and the testing status of the selected pump.

If the unit is in [STANDBY](#) mode, the testing status enables to manually start the pump in order to clean the system.

There is no option to enable/disable the pump.

3.13 Alarms Menu

This area is accessible from the Main [Menu](#) or by pressing function key F3.

Displays an overview of the alarms section.

- Active: initial line of the related submenu.
- History: initial line of the related submenu.
- [Reset](#): resets all the manual alarms that can be [reset](#). This option also enables to [reset](#) the number of occurrences per hour of the [reset](#) alarms.

The only active function of this screen is the one that enables to [reset](#) all resettable alarms that can be [reset](#) manually.

- If RES is displayed, manually resettable alarms can be [reset](#).
- If OFF is displayed, no alarm can be [reset](#) or no alarms are available.

The Alarm [Menu](#) opens automatically when an alarm occurs, displaying the label only.

The active alarms of the [Alarms Menu](#) are grouped as follows:

- Unit alarm: the alarm has blocked the unit.
- Alarm of circuit n evaporator n: an alarm has occurred

3.14 System_Alarms

All active manually or automatically resettable alarms are displayed along with the date and time of the alarm. A list similar to one shown below is displayed:

Alarm n
Status of alarm n

3.15 Alarms_regulation

All active manually or automatically resettable alarms are displayed, along with the date and time of the alarm. A list similar to the one shown below is displayed:

Alarm n
Status of alarm n

3.16 Alarms_history_list

This is the alarms database.

The following fields are displayed:

List

- Displays the alarms history, along with the time and date, starting from the most recent one.
- Displays the list of alarms present in the history, along with information on the type of alarm, the date and time in which it has occurred and its frequency per hour.
- The first alarm to be displayed is the last one of the queue.

[Reset](#): enables to delete all the alarms of the history:

- RES if the history contains alarms.
- EMPTY if the history contains no alarms.

10 minutes:

- Displays the alarms occurred in the last 10 minutes

The history may contain a maximum of 100 alarms.

- ADR= Address of the device on which the alarm has occurred.
- F RQ= Hourly frequency of the alarm (number of occurrences of the alarm in one hour).

After a new occurrence, the alarm is entered in the history. If the alarm occurs at the same time, it causes an increase

3.17 User_Parameters

Enables to change [Class H](#) and C parameters of the controller. For further information see the [Table](#) of parameters. Parameters are grouped by:

- Configuration
- Alarms
- Compressor
- Pump
- [Heat recovery](#)
- [Free cooling](#)
- Ventilation
- Modem
- [Dynamic set point](#)

The selection of a group of parameters opens a submenu that lists the parameters along with their current value, enabling the user to change them.

3.18 Enter_(Cg12) Config Password

[\(Cg12\) Config Password](#) Setting

3.18.1 Enter_(Cg12) Config Password_CARD_0

Card's view

[\(CG12\) CONFIG PASSWORD](#)

* * * * *

This [menu](#) enables to set the [\(Cg12\) Config Password](#) for protected access. The [\(Cg12\) Config Password](#) is constituted by 5 alphanumeric characters that can be set by the user with keys UP and DOWN. To move to the next character, use key RIGHT circularly.

The entry of the [\(Cg12\) Config Password](#) enables to display/edit the menus and parameters protected by a [\(Cg12\) Config Password](#).

This [menu](#) is used to access the parameters that are visible only after the entry of the [\(Cg12\) Config Password](#).

If the entered [\(CG12\) CONFIG PASSWORD](#) coincides with the set one, OK is displayed. Otherwise KO is displayed. The factory set [\(Cg12\) Config Password](#) is EEEE. The entry of the [\(Cg12\) Config Password](#) enables to display all the parameters of Energy XT.

The [\(Cg12\) Config Password](#) is cancelled if the user returns to the main [menu](#) or after the time-out period.

3.19 Time Bands Menu

This [menu](#) enables to activate the [time bands](#) and select one of the 3 different timers available:

- Daily (every day has a different setting)
- Weekly (the same setting is applied to all the days of the week)
- 5+2: Setting for work days (Mon-Fri) and holidays (Sat-Sun)

3.20 Time_Bands_Settings

This [menu](#) displays the weekdays that can be used to access the settings. For further information see subchapter [Time bands](#)

3.20.1 Time_Bands_Settings_CARD_0

Card's view

PARAM
Pg/Pg

Monday

Tuesday

Wednesday

Mon - Wed

3.20.2 Time_Bands_Settings_CARD_1

Card's view

PARAM

Pg/Pg

Thursday

Friday

Saturday

Thu - Sat

3.20.3 Time_Bands_Settings_CARD_2

Card's view

PARAM

Pg/Pg

Sunday

Weekly

Monday->Friday

Sun, Weekly, 5+2

3.21 Time_Band_Copy_functions

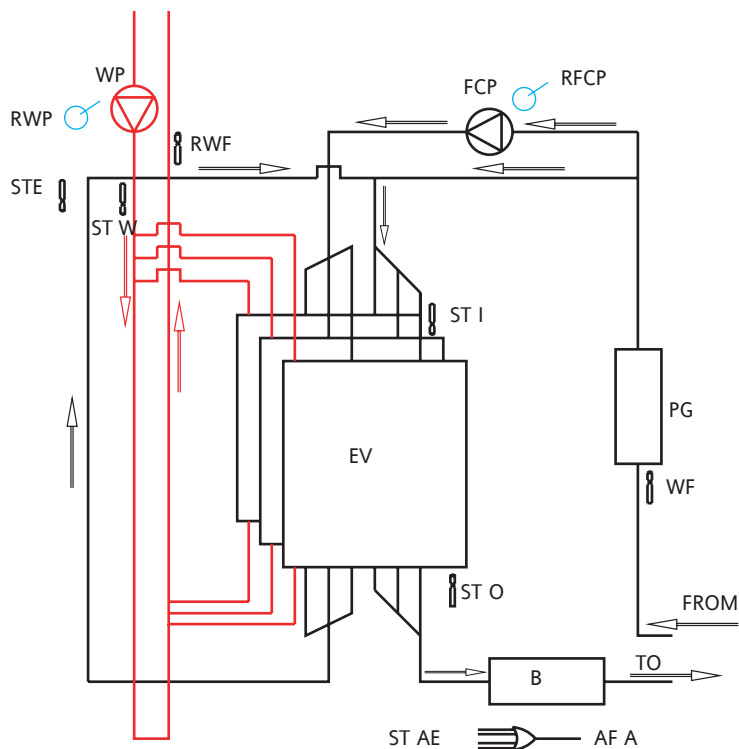
These enable to copy the time band settings from one day to another. For further information see subchapter [Time bands](#).

4 SYSTEM CONFIGURATION

This chapter illustrates the possible configurations of Energy XT, which vary according to the *type of system*.

4.1 Type of system

Example of system



EV: Evaporator group	B: Tank
PG: Pump group	FCP: Free cooling pump
WP: Recovery water pump	ST I: Temperature probe – Input
ST O: Temperature probe – Output	ST W: Temperature probe – Recovery water
ST E: External temperature probe	ST AE: Temperature probe – Anti-freeze of evaporator 1..n
WF: Water flow switch	AF A: Anti-freeze alarm
RFCP: Relay – Free cooling pump	RWP: Relay-Recovery water pump
FROM: Water from user	TO: Water to user

The system to be controlled is constituted by a water circuit that is "connected" to a user and "supplied from" a user. The user receives the water at a specific temperature and supplies it, in turn, at a different temperature (that can be higher or lower).

Linked components

Each system can be linked to the following components:

	NAME	NUMBER (per system)	RANGE
COMPONENTS	Evaporation group	1..4	
	Pump group	0/1	
	Free cooling pump	0/1	
	Recovery water pump	0/1	
	Tank		
ACTUATOR	Free cooling pump	0/1	0..1

S	Recovery water pump	0/1	0..1
PROBES	Flow switch for the water of the main circuit	1	1
	Flow switch for the recovery circuit	0/1	0..1
	Flow switch for the <i>free cooling</i> circuit	0/1	0..1
	Temperature probe on evaporator input	1	1 per unit
	Temperature probe on evaporator output	1..4	1 per evaporator, + 1 optional shared
	Temperature probe for recovery water		
	External temperature probe for <i>free cooling</i> (<i>dynamic set point</i>)	0/1	

Alarms Each system provides the following alarms:

ALARM SIGNALS	NUMBER (per group)	RANGE
<i>Heat recovery pump thermal switch alarm</i>	0/1	0..1
Thermal switch alarm for <i>free cooling pump</i>	0/1	0..1

Error signals Each system provides the following error signals:

ERROR SIGNALS	NUMBER (per group)	RANGE
Temperature probe error on evaporator input	1	0..1
Temperature probe input on evaporator output	1..4*	0..1
Temperature probe error for recovery water	0/1	0..1
Temperature probe error for <i>free cooling</i>	0/1	0..1



* In some cases, the probe labelled with * in the *table* above may not be physically present; consequently its reading is acquired by averaging the temperatures measured by anti-freeze probes. This detail is not however important for the purposes of the controller design. The important thing is that the other probes are available.

CONFIGURATION PARAMETERS

Type Energy XT enables to control the types of systems specified by the following *Class F* parameter:

- (SY11) *PLANT TYPE*

Evaporators The number of evaporators in the system is specified by the following *Class C* parameter:

- (SY01) *EVAPORATORS NUMBER*

The number must *range* between the minimum and maximum number of evaporators that Energy XT can control, which is specified by the following *Class F* parameter:

- (SY02) *EVAPORATORS MIN NUMBER*
- (SY03) *EVAPORATORS MAX NUMBER*

Pump group If Energy XT is enabled to use a *pump group*, the following *Class F* parameter must be active:

- (SY12) *PUMP GROUP ENABLE*

The number of pumps of the system can be controlled with the following *Class C* parameter:

- (SY10) *PUMPS NUMBER* (max 2)



This parameter is relevant even if Energy XT does not control pumps directly.

Each *pump group* is linked to a digital output of Energy XT. The output is specified during the I/O allocation session of the *Configuration wizard*.

4.1.1 Start mode

Starting the system Energy XT enables to start the system in *Cooling* or in Heat Pump mode. The setting can be specified with the following *Class C* parameter:

- (SP02) *UNIT STARTING MODE*

Its value is constant for systems with *Cooling* or Heat Pump mode, but can be changed during operation for *reversible systems*.



This parameter changes every time the *operating mode* is changed from the keyboard: if the digital input mode (remote *heating/cooling*) is inactive and no time band has been enabled, the system restarts from the last configured status.

Reversible systems *Reversible systems* can be configured with the following *Class C* parameter:

- (SP06) *REVERSABLE HEAT-PUMP ENABLE*



If selected, this parameter enables *reversible systems* to be switched from *cooling* to *heating* provided that Energy XT supports both *functions*.

If this parameter is disabled, *reversible systems* are not able to switch the function and can therefore run only in *Cooling* or *Heating* mode, depending on the setting of variable (SP02) *UNIT STARTING MODE*.
For further information, see also parameter (SY11) *PLANT TYPE*

If Energy XT has an input to remotely control the switching from the *Cooling* to the *Heating* mode, the following *Class F* parameter must be active:

- (SP09) REMOTE OFF INPUT PRESENCE

This parameter is relevant only if the system is reversible and not forced to operate in *Cooling* or *Heating* mode only.

If selected, the I/O map enables to allocate an input for the switching of the system. The input is configured during the I/O allocation session of the *Configuration wizard*.

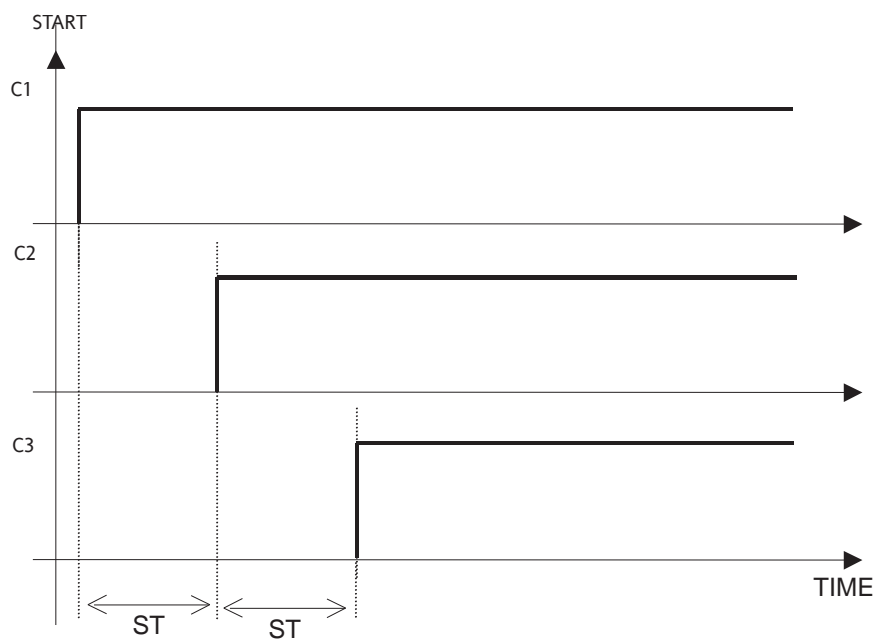
Soft start

The Soft Start function enables to set a minimum interval of time between the enabling of the capacity steps of *compressors*.

If one compressor is active and the temperature control requires the start of another compressor, the command is performed only after the (SP01) SOFT START TIME interval has elapsed.

Applicable parameters:

- (SP07) SOFT START ENABLE ENABLE
Class C parameter that determines whether Energy XT can perform a soft start.
- (SP01) SOFT START TIME
Class H parameter that specifies the length of the soft start, which corresponds to the interval of time between two compressor starts.



START : Compressor start	TIME: Time
C1: Compressor 1	ST: sSP01
C2: Compressor 2	C3: Compressor 3

4.1.2 Free cooling pump

Pressure

To use the *Free Cooling* function, it is necessary to have an external temperature probe.

If Energy XT is enabled to control the *free cooling*, the following *Class F* parameter must be active:

- (FC04) FREECOOLING: SENSOR

This parameter specifies the number of *temperature sensors* that will be used.

If *temperature sensors* are used for *free cooling*, each of them is linked to an analogue input of Energy XT. Inputs are configured during the I/O allocation session of the *Configuration wizard*.

If Energy XT uses a group of pumps for the *free cooling*, the following *Class F* parameter must be active:

- (SY12) PUMP GROUP ENABLE

Each *pump group* used for the *free cooling* is linked to a digital output of Energy XT. Outputs are configured during the I/O allocation session of the *Configuration wizard*.

4.1.3 System: Heat recovery

Heat recovery: probes

If Energy XT is enabled to control the *heat recovery* function, the following *Class F* parameter must be active:

- (HR09) HEAT RECOVERY: FLOW SWITCH PRESENCE
This parameter specifies whether a flow switch is available for the *heat recovery*.

Heat recovery: water pump

If Energy XT is enabled to use a *heat recovery* pump, the following *Class F* parameter must be active:

- (HR10) HEAT RECOVERY: PUMP PRESENCE



Each [pump group](#) used for the recovery of heat is linked to a digital output of Energy XT. Outputs are configured during the I/O allocation session of the [Configuration wizard](#).

- (HR11) [HEAT RECOVERY: TEMPERATURE SENSOR PRESENCE](#)

This [Class F](#) variable specifies whether the system uses a [temperature sensor](#) for [heat recovery](#).

- (HR12) [HEAT RECOVERY: PRESSURE DIGITAL INPUT PRESENCE](#)

This [Class F](#) parameter specifies whether the system uses a digital input for [heat recovery](#).

4.1.4 System: Dynamic set point

Dynamic set point:
sensor

If Energy XT is enabled to use an external [temperature sensor](#) for the Dynamic Tset algorithm, the following [Class F](#) parameter must be active:

- (SY13) [DYNAMIC TSET EXTERNAL TEMPERATURE SENSOR](#)



In this case, it is necessary to link an analogue input to Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

If the system uses a 4–20 mA sensor to apply the Dynamic Tset algorithm, the following [Class F](#) parameter must be active:

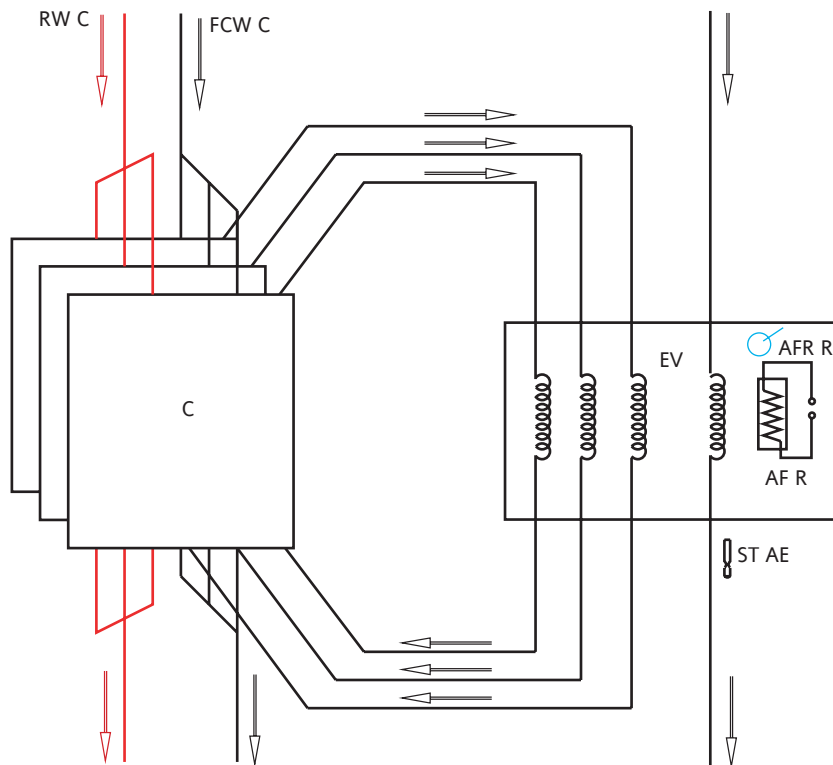
- (SY14) [DYNAMIC TSET CURRENT SENSOR](#)



In this case, it is necessary to link an analogue input to Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

4.2 Evaporator group

Example of *evaporator group*:



RWC: Recovery water circuit	FCWC: <i>Free cooling</i> water circuit
C: Circuit	EV: Evaporator
AFR: <i>Anti-freeze electric heaters</i>	ST AE: Anti-freeze temperature probe
AFR R: Relay of <i>anti-freeze electric heaters</i>	

Linked components

Each *evaporator group* can be linked to the following components:

	NAME	NUMBER (per group)	RANGE
COMPONENTS	Evaporators	1	
	<i>Circuits</i>	1..4	
	Anti-freeze electric heater	0/1	Depending on the type of unit (chiller, heat pump, reversible)
ACTUATORS	Relay of <i>anti-freeze electric heaters</i>	0/1	0..1
PROBES	Anti-freeze temperature probe	1	Equivalent to the temperature probe on the output of the evaporator

Error signals

Each *evaporator group* provides the following error signals:

ERROR SIGNALS	NUMBER (per group)	RANGE
Anti-freeze temperature probe error	1	0..1

CONFIGURATION PARAMETERS

Configuration Number of circuits

The number of [circuits](#) per evaporator is determined by the following [Class C](#) parameter:

- [\(SY01\) EVAPORATORS NUMBER](#)

The number must [range](#) between the minimum and maximum number of evaporators that Energy XT can control, which is specified by the following [Class F](#) parameter:

- [\(SY02\) EVAPORATORS MIN NUMBER](#)
- [\(SY03\) EVAPORATORS MAX NUMBER](#)

Evaporators: selection algorithms

4.2.1 Selecting the evaporator selection algorithm

If several evaporators are present in the same circuit, their operation can be controlled with two algorithms:

- [Saturation](#)
The evaporator in use is exploited to its maximum power before the second evaporator is switched on.
- [Balancing](#)
All the available evaporators are switched on simultaneously in a balanced manner.

For further information, see chapter "Selection of [cooling](#) resources".

If Energy XT is enabled to use a [saturation](#) algorithm for the evaporators, the following [Class F](#) parameter:

- [\(SP03\) EVAPORATORS' SELECTION LOGIC](#)
Must be set to EV_ [SATURATION](#)

If Energy XT is enabled to use a [balancing](#) algorithm for the evaporators, the following [Class F](#) parameter:

- [\(SP03\) EVAPORATORS' SELECTION LOGIC](#)
Must be set to EV_ [BALANCING](#)

4.2.2 Temperature sensor

Some systems have a shared [temperature sensor](#) on the output of the system evaporators. If present, it is used for temperature control; otherwise the system acquires the signals output from each evaporator (average value).

If Energy XT is enabled to use a shared [temperature sensor](#), the following [Class F](#) parameter must be active:

- [\(ST10\) TEMP SENSOR SHARED FOR EVAPORATORS ENABLE](#)



In this case the sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

4.2.3 Anti-freeze electric heaters

Chiller or reversible units (operating in chiller mode) can have an anti-freeze electric heater for the evaporator.

If Energy XT is enabled to use it, the following [Class F](#) parameter must be active:

- [\(AF11\) ANTIFREEZE: EVAPORATOR ELECTRIC HEATER PRESENCE](#)

[Anti-freeze electric heaters](#) are enabled by the anti-freeze alarm.



The anti-freeze electric heater is associated to a digital output of Energy XT. The output is configured during the I/O allocation session of the [Configuration wizard](#).

For further information, see chapter Anti-freeze alarms.

4.2.4 Integration electric heaters

[Integration electric heaters](#) are generally used in systems for the production of heat (heat pump) to increase the heat production capacity in particular during the start-up phase.

The following parameters apply:

- [\(AT03\) SUPPLEMENTARY HEATING: ENABLE](#)
[Class C](#) parameter that enables/disables the [integration electric heaters](#). If enabled, the evaporator electric heaters are used to integrate the operation of the heat pump.



The regulator is configured according to the temperature of the water input to the main circuit.

- [\(AT02\) SUPPLEMENTARY HEATING: TEMP DIFFERENTIAL TO ENABLE HEATERS](#)
[Class H](#) parameter that specifies the temperature difference used to trigger the [integration electric heaters](#) of the evaporator:
- [\(AT01\) SUPPLEMENTARY HEATING: EVAP HEATER BOOST PROPORTIONAL BAND](#)
[Class H](#) parameter that specifies the proportional band for the [integration electric heaters](#):

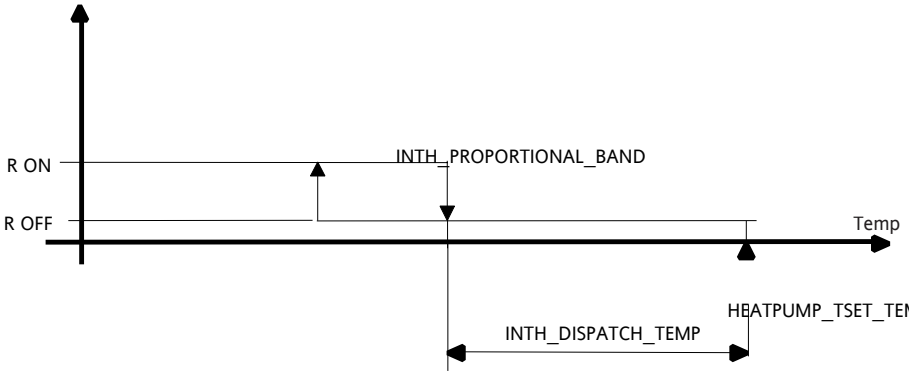
Electric heaters are active if:

- The temperature of the water input to the circuit is below:
(MH01) [HEATING: SET POINT](#) - [\(AT02\) SUPPLEMENTARY HEATING: TEMP DIFFERENTIAL TO ENABLE HEATERS](#) - [\(AT01\) SUPPLEMENTARY HEATING: EVAP HEATER BOOST PROPORTIONAL BAND](#).

Electric heaters are disabled if:

- The temperature rises above:
(MH01) [HEATING: SET POINT](#) - [\(AT02\) SUPPLEMENTARY HEATING: TEMP DIFFERENTIAL TO ENABLE HEATERS](#).

For further information, refer to the diagram below:



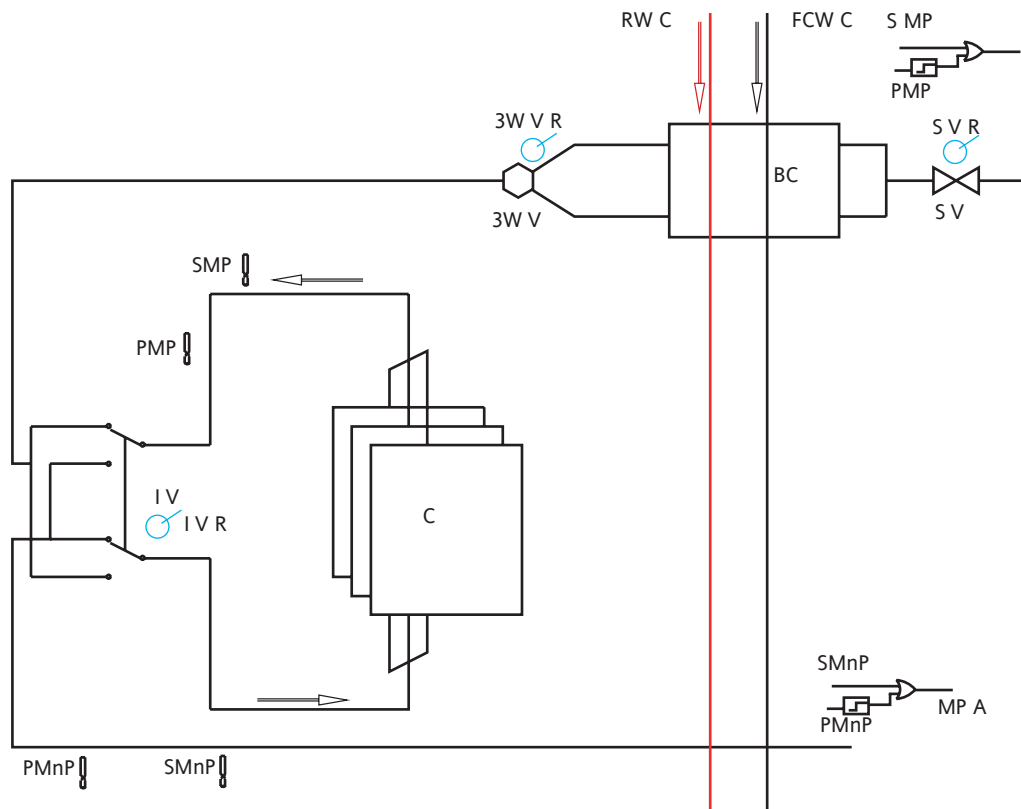
Temp: Temperature	R ON: Electric heaters on	R OFF: Electric heaters off
-------------------	---------------------------	-----------------------------



The *integration electric heaters* of an evaporator of a system with a heat pump represent the electric heaters that are physically used for anti-freeze function if the system is reversible or running in chiller mode. Electric heaters are controlled in steps and proportionally with band *(AT01) SUPPLEMENTARY HEATING: EVAP HEATER BOOST PROPORTIONAL BAND*. Electric heaters are switched on in a fixed order.

4.3 Circuits

Example of (reversible) circuit:



RWC: Recovery water circuit	FCWC: <i>Free cooling</i> water circuit
3W V: <i>3-way valve</i>	3W V R: Three-way valve relay
S V: Solenoid valve	S V R: Solenoid valve relay
B C: <i>Condenser group</i>	I V: Reverse valve
C: Compressor	MP A: Minimum pressure alarm
S MP: Maximum pressure probe	PMP: Maximum pressure pressure switch
S MnP: Minimum pressure probe	PMnP: Minimum pressure pressure switch
IVR: <i>Reversing valve</i> relay	



Non reversible *circuits* do not have a *reversing valve*.

Linked components

Each circuit can be linked to the following components:

	NAME	NUMBER (per circuit)	RANGE
COMPONENTS	<i>Compressors</i>	1..4	
	<i>Condenser group</i>	1	
	Solenoid valve	0/1	
	<i>3-way valve</i>	0/1	
	Reverse valve	0/1	
ACTUATORS	Solenoid valve relay	0/1	0..1
	<i>3-way valve</i>	0/1	0..1
	<i>Reversing valve</i> relay	0/1	0..1
PROBES	Minimum pressure probe	0/1	
	Maximum pressure probe	0/1	
	Minimum pressure pressure switch	0/1	0..1 (instead of minimum pressure probe)
	Maximum pressure pressure switch	0/1	0..1 (instead of maximum pressure probe)

Error signals

Each circuit can be linked to the following error signals:

ERROR SIGNALS	NUMBER (per group)	RANGE
Minimum pressure probe error	1	0..1
Maximum pressure probe error	1	0..1

CONFIGURATION PARAMETERS

Configuration

The number of [compressors](#) per circuit is specified by the following [Class C](#) parameter:

- [\(SY07\) COMPRESSORS NUMBER](#)

The number must [range](#) between the minimum and maximum number of [compressors](#) per circuit that Energy XT is able to control, which is specified by the following [Class F](#) parameter:

- [\(SY08\) COMPRESSORS MIN NUMBER](#)
- [\(SY09\) COMPRESSORS MAX NUMBER](#)



Each compressor is linked to at least one digital output of Energy XT. The output is configured during the I/O allocation session of the [Configuration wizard](#).

4.3.1 Selecting the circuit selection algorithm

If several [circuits](#) are present in the same system, their operation can be controlled with two algorithms:

- [Saturation](#)
The circuit in use is exploited to its maximum power before the second circuit is switched on.
- [Balancing](#)
All the available [circuits](#) are switched on simultaneously in a balanced manner.

For further information, see chapter "Selection of [cooling](#) resources".

If Energy XT is enabled to use a [saturation](#) algorithm for the [circuits](#), the following [Class F](#) parameter must be active:

- [\(SP04\) CIRCUITS' SELECTION LOGIC](#)
Must be set to CR_ [SATURATION](#)

If Energy XT is enabled to use a [balancing](#) algorithm for the [circuits](#), the following [Class F](#) parameter must be active:

- [\(SP04\) CIRCUITS' SELECTION LOGIC](#)
Must be set to CR_ [BALANCING](#)

If Energy XT is enabled to use both selection algorithms (see parameters described above), the following [Class C](#) parameter must be active:

- [\(SP04\) CIRCUITS' SELECTION LOGIC](#)

This parameter specifies the algorithm that must be enabled after the powering on of the system.

4.3.2 Circuits: valves

Solenoid valve

If Energy XT is enabled to use a solenoid valve, the following [Class F](#) parameter must be active:

- [\(PD07\) PUMPDOWN: SOLENOID VALVE PRESENCE](#)



The valve is linked to a digital output of Energy XT. The output is configured during the I/O allocation session of the [Configuration wizard](#).

3-way valve

If Energy XT is enabled to use a [3-way valve](#), the following [Class F](#) parameter must be active:

- [\(HR13\) HEAT RECOVERY: THREE WAY VALVE PRESENCE](#)



The [3-way valve](#) is present when the [heat recovery](#) function is available.
[3-way valves](#) are used for the [free cooling](#) function.



The valve is linked to a digital output of Energy XT. The output is configured during the I/O allocation session of the [Configuration wizard](#).

Reversing valve

If Energy XT is enabled to use a [reversing valve](#) for systems that can be reversed during the [Cooling](#) mode (with heat pump), the following [Class F](#) parameter must be active:

- [\(RV01\) REVERVING VALVE PRESENCE](#)



The valve is linked to a digital output of Energy XT. The output is configured during the I/O allocation session of the [Configuration wizard](#).

4.3.3 Circuits: Pressure sensors

Oil pressure: probes

If Energy XT is enabled to use a sensor to measure the value of the pressure of the gas (high pressure for [cooling](#) and low pressure for [heating](#)), the following [Class F](#) parameter must be active:

- [\(CR01\) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE](#)



In this case the sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

If Energy XT is enabled to use a sensor to measure the value of the pressure of the gas (low pressure for [cooling](#) and high pressure for [heating](#)), the following [Class F](#) parameter must be active:

- [\(CR03\) COOLING LOW PRESSURE ALARM SENSOR PRESENCE](#)



In this case the sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

If Energy XT is enabled to use digital gas pressure sensors, the following [Class F](#) parameters are active:

- [\(CR04\) COOLING HIGH PRESSURE ALARM DIGITAL INPUT PRESENCE](#)



For high pressure (delivery)

- [\(CR02\) COOLING LOW PRESSURE ALARM DIGITAL INPUT PRESENCE](#)

For low pressure (suction)

In this case, the sensors are linked to the digital inputs of Energy XT. Inputs are configured during the I/O allocation session of the [Configuration wizard](#).

4.3.4 Circuits: Pump Down

Pressure
probe

If Energy XT is enabled to use a pressure digital input for the [pump down](#), the following [Class F](#) parameter must be active:

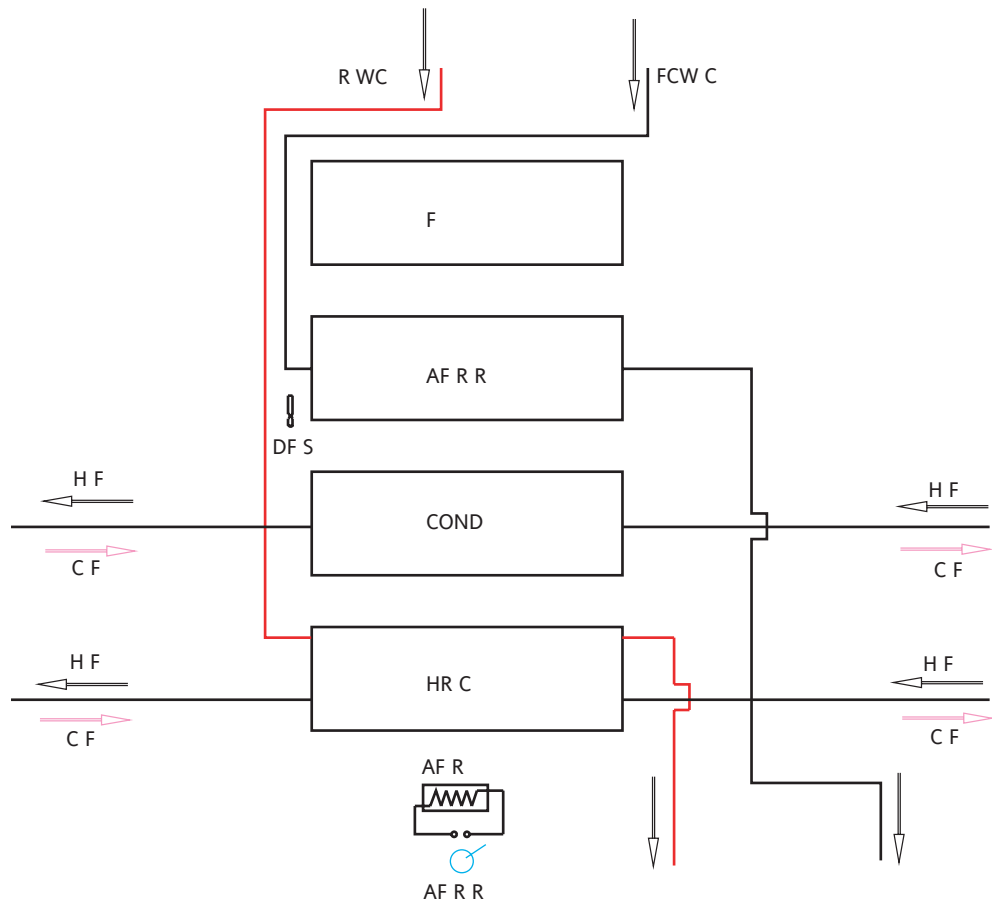
- [\(PD08\) PUMPDOWN: PRESSURE DIGITAL INPUT PRESENCE](#)



The pressure sensor is linked to a digital input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

4.4 Condenser group

Example of a *condenser group*:



RWC: Recovery water circuit	FCWC: <i>Free cooling</i> water circuit
HF: Hot Freon	CF: Cold Freon
AF R: <i>Defrost</i> electric heater	AF R R: <i>Defrost</i> electric heater relay
F: <i>Fan group</i>	FCC: <i>Free Cooling</i> Coils
COND: Condenser	HR C: <i>Heat recovery</i> coils
DF S: <i>Defrost</i> probe	

Linked components

Each *condenser group* can be linked to the following components:

	NAME	NUMBER (per group)	RANGE
COMPONENTS	<i>Fan group</i>	0/1	
	Condenser	1	
	<i>Heat recovery</i> coil	0/1	
	<i>Free cooling</i> coil	0/1	
	Anti-freeze electric heater	0/1	
ACTUATORS	Anti-freeze electric heater relay	0/1	0..1
	<i>Defrost</i> probe	0/2	
PROBES	Temperature probe for step control	0/1	

Error signals

Each *condenser group* can be linked to the following error signals:

ERROR SIGNALS	NUMBER (per group)	RANGE
<i>Defrost</i> probe error	0/1	0..1

CONFIGURATION PARAMETERS

Number of fans

The number of fans per condenser can be selected with the following *Class C* parameter:

- *(FP01) FANS: NUMBER OF FANS PER CIRCUIT*

The configurable number is limited by the following *Class F* parameters:

- *(FP02) FANS: MIN NUMBER OF FANS PER CIRCUIT*
This parameter specifies the minimum number of fans that Energy XT can support.
- *(FP03) FANS: MAX NUMBER OF FANS PER CIRCUIT*
This parameter specifies the maximum number of fans that Energy XT can support.

4.4.1 Condenser control

Energy XT is able to control the condenser by means of the following temperature/pressure sensors:

Temperature sensor

If the condenser has a *temperature sensor*, the following *Class C* parameter needs to be enabled:

- *(FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE*

This sensor is used to control the fans and the *defrost* function.



If present, the *temperature sensor* is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the *Configuration wizard*.

If digital temperature probes are present, the following *Class C* parameter needs to be enabled:

- *(FP07) FANS: TEMPERATURE DIGITAL INPUT DEDICATED FOR FANS PRESENCE*



If used, the digital temperature probe is linked to a digital input of Energy XT. The input is configured during the I/O allocation session of the *Configuration wizard*.

If Energy XT uses a circuit sensor to measure the gas pressure (high pressure in *cooling* mode and low pressure in *heating* mode), the following *Class F* parameter must be active:

- *(CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE*



If used, the circuit sensor for the measurement of the gas pressure is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the *Configuration wizard*.

4.4.2 Condenser defrosting

If Energy XT is enabled to use an electric heater for the defrosting of the condenser (reversible units may not require this heater as they are unable to reverse the cycle for defrosting), the following *Class F* parameter must be active:

- *(DF23) DEFROST: CONDENSER ELECTRIC HEATER PRESENCE*

If Energy XT is enabled to use other sensors in addition to the *temperature sensor* of the condenser to measure the *defrost* temperature (see *(FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE*), the following *Class F* parameter must be active:

- *(DF12) DEFROST: CONDENSER DF ADDITIONAL TEMP SENSORS ENABLE*

This parameter specifies the number of additional sensors (for further information, see chapter *Defrost*).



Each additional sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the *Configuration wizard*.

If Energy XT is enabled to use additional sensors to measure the pressure of the condenser for defrosting (see *(FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE*), the following *Class F* parameter must be active:

- *(DF13) DEFROST: CONDENSER DF ADDITIONAL PRESS SENSORS ENABLE*

This parameter specifies the number of additional sensors.



Each additional sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the *Configuration wizard*.



The selection of analogue or digital inputs is based on the type of fans installed. Outputs are configured during the I/O allocation session.

4.5 Single condensing

Single condensing is used for units where the condensing *circuits* are placed on a single group of fans.

In these units, each circuit has its own temperature/pressure sensor and operating sequence, as described in previous chapters. However, fans are controlled by all the *circuits* that belong to the same group of fans.

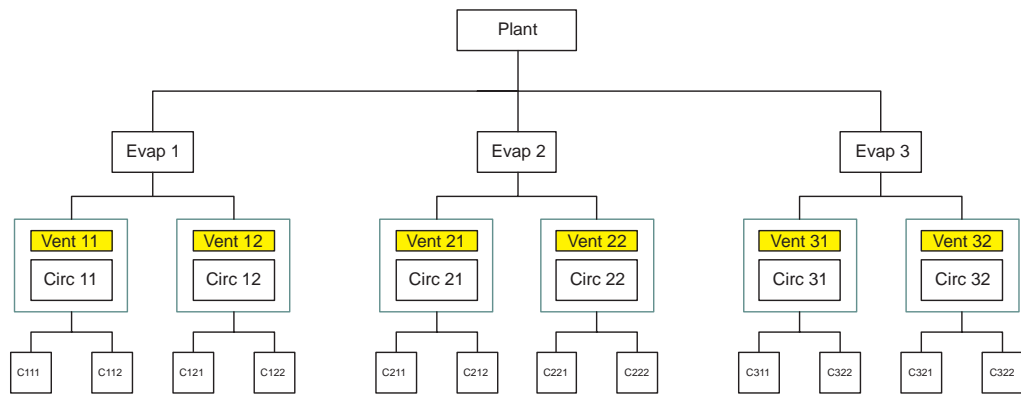
Single condensing can be enabled with the following parameter:

- *(SY16) COMBINE CONDENSATION*

Fan groups can be specified by means of the following parameter:

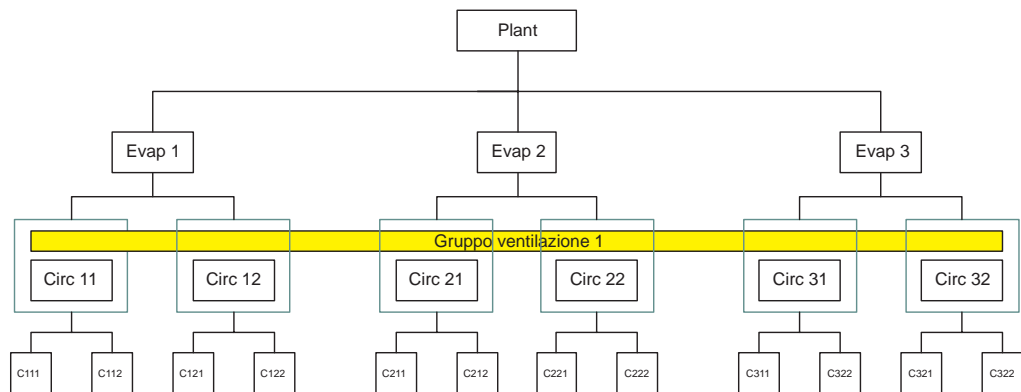
- *(SY17) NUMBER OF FANS GROUPS*

If *(SY16) COMBINE CONDENSATION=0*, there will one group of fans for each circuit, as shown in the figure. The figure shows a unit with 3 evaporators and 2 *circuits* per evaporator.

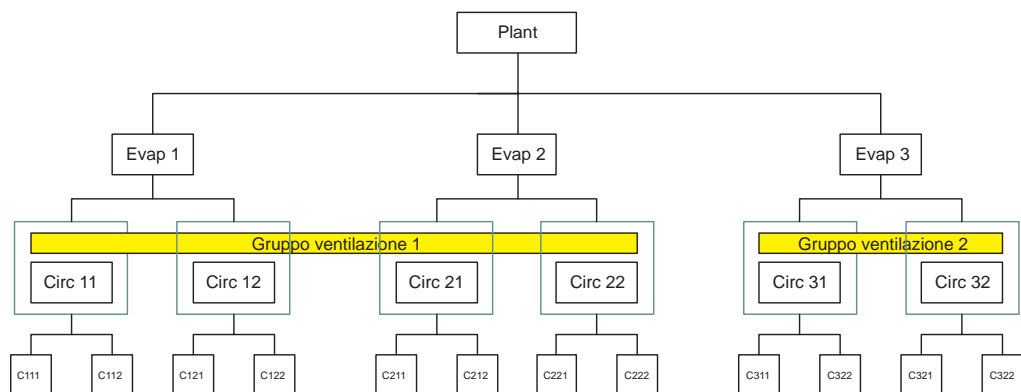


If (SY16) *COMBINE CONDENSATION*=1, evaporators are grouped in groups of fans as specified by parameters (SY17) *NUMBER OF FANS GROUPS* and (SY01) *EVAPORATORS NUMBER*. It is useful to notice that parameter (SY17) *NUMBER OF FANS GROUPS* must always be <= to (SY01) *EVAPORATORS NUMBER*. Therefore, the system may comprise a maximum of (SY01) *EVAPORATORS NUMBER* groups of fans.

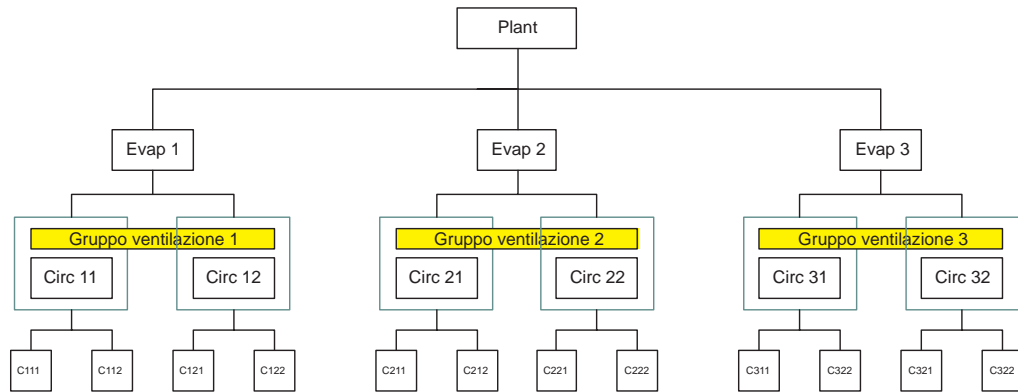
(SY17) *NUMBER OF FANS GROUPS*=1:



(SY17) *NUMBER OF FANS GROUPS*=2:



(SY17) *NUMBER OF FANS GROUPS*=3:



The rules applicable to this type of unit are the following.

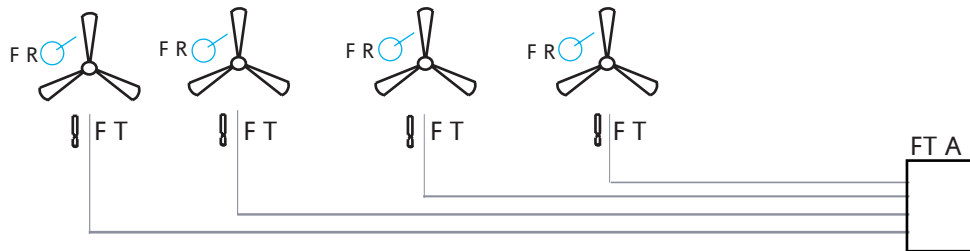
- During ordinary temperature control, the fans of the *fan group* set each circuit running in *COOLING* mode to the maximum ventilation power and to minimum for the *HEATING* mode.
- If the probe controlling the fans of a circuit that belongs to the group of fans enters the error mode, the fans of the group run at maximum power.
- In *Defrost* mode, a circuit that has the required *defrost* conditions, forces the others joined to it to start the *defrost* function, provided that these are not forced to interrupt the *defrost* operation. In this case, the circuit is powered off until all the linked *circuits* have completed the *defrost*. The first circuit to complete the operation waits for the remaining ones.
- If the de-tearing time differs from 0, all the *circuits* perform the de-tearing at the same time and for the same amount of time.
- During *defrost*, fans run at maximum power if the *defrost* probe of at least one circuit exceeds the "start fans in *defrost*" threshold. For further information, see chapter *Defrost*.
- Fans will also run at maximum power if one of the *defrost* probes enters the error mode.
- During de-tearing, fans are operated at maximum power if parameter: *(DF25) DEFROST: FANS MAX POWER ON DRIPPIN'*=1 and be off in all other cases.



The enabling of the thermal switches of fans always blocks the *fan group* (except in Chiller mode if parameter *(FP09) FANS: INDIVIDUALLY FANS STOP IN CASE OF ALARM ENABLE*=1, which causes the issue of a signal only). In all other cases, the *fan group* is blocked only if all the *circuits* of the specified group are in alarm mode.

4.6 Fan group

Example of *fan group*:



It is always useful to consider the following.
Each *fan group* can be linked to the following components:

Linked components

	NAME	NUMBER (per group)	RANGE
COMPONENTS	Fans	0..8	
ACTUATORS	Fan control relay/modulating analogue output	1 per fan / 1 per group of fans	Depending on whether a modulating fan is present. 0..1 or 0.. 100% (percentage output) The maximum and minimum values are always within these two parameters.
PROBES	Fan thermal switch	1 per fan / 1 per group of fans	0..1

Alarms

Each *fan group* can be associated to the following alarms:

ALARM SIGNALS	NUMBER (per group)	RANGE
Fan thermal switch alarm	1	0..1

CONFIGURATION PARAMETERS

Configuration

According to the type of installed fans ((FP04) FANS: FANS TYPE), fans can be controlled in three different ways:

- Digital (stepping ON/OFF regulation)
- Continuous (proportional regulation)
- Maxpower (ON/OFF regulation at maximum power at any time)

digital

If Energy XT permits the use of Digital control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE

continuous

If Energy XT permits the use of Continuous control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE

maxpower

If Energy XT permits the use of Maxpower control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE

The available modes can be selected through the *class C* parameter:

- (FP01) FANS: CONTROL TYPE

After configuration, modes can be selected with the following *Class C* parameter:

- (FP04) FANS: FANS TYPE

If Energy XT is configured to use fans of different sizes in the same circuit, the following *Class C* parameter must be active:

- (FP05) FANS: DIFFERENT FANS MANAGEMENT ENABLE



This parameter enables to operate the fans in parallel or in sequence (provided that at least one fan is always active).

The thermal switch alarms of fans are controlled with the following *Class F* parameter:

- (FP08) FANS: SINGLE FANS ALARM INPUT PER CONDENSER PRESENCE

This parameter specifies whether Energy XT should receive a single input from each condenser or from each fan.

- If disabled, Energy XT expects to receive a single input from each fan.
- If enabled, Energy XT expects to receive a single input from each condenser.

4.6.1 Active fans with condensation probe alarm

If the condensation probe is faulty (i.e. only when the probe controls the fans), parameter

- *(FF04) FANS: MAX POWER IF CONDENSER SENSOR IS FAULTY*

determines whether the fans and the related circuit must be switched off or if they must be operated at maximum power leaving the circuit on.

The alarm is disabled in Heat Pump mode because the fans are always off in this configuration.

4.6.2 Selectable fan thermal switch

It is possible to choose to power off the fan only without the circuit when a fan thermal switch alarm occurs.

In this case, the control carried out is a normal one as it bypasses the fan in alarm mode, which is not enabled.

To enable this function, it is necessary to set parameter

- *(FP09) FANS: INDIVIDUALLY FANS STOP IN CASE OF ALARM ENABLE*

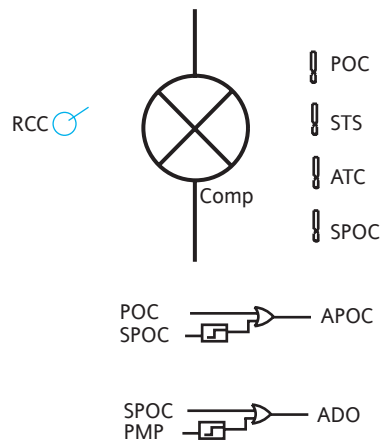
to TRUE

This function can be enabled if :

- The fans are controlled digitally (parameter *(FP04) FANS: FANS TYPE* = DIGITAL);
- The input of the fan thermal switch digital input is not shared (parameter *(FP08) FANS: SINGLE FANS ALARM INPUT PER CONDENSER PRESENCE*= FALSE)
- All the fan thermal switch digital inputs are disabled.

4.7 Compressors

Example of *compressors*:



POC: Oil pressure switch of compressor	STS: Discharge temperature probe
ATC: <i>Compressor thermal alarms</i>	Comp: Compressor
SPOC: Oil pressure probe of compressor	PMP: Minimum pressure pressure switch
APOC: Oil pressure alarm of compressor	ADO: Oil differential alarm

Linked components

Each compressor can be linked to the following components:

	NAME	NUMBER (per group)	RANGE
COMPONENTS	Compressor	1	
ACTUATORS	Number of capacity steps	$0 \leq n \leq 3$	
	Compressor control relay	1	Depending on the type of compressor: with/without capacity steps and with/without <i>part winding</i> .
PROBES	Oil pressure switch of compressor	1	0..1
	Discharge temperature probe of digital input/output	1 (One of the two is always present)	
	Oil pressure probe of compressor	1	
	Digital thermal switch probe alarm		

Alarms

Each compressor is linked to the following alarms:

ALARM SIGNALS	NUMBER (per group)	RANGE
<i>Compressor thermal alarms</i>	1	0..1

Discharge temperature alarm	1	
Oil pressure switch alarm of compressor		0..1
Oil differential alarm of compressor	Depending on the configuration of the circuit probes. The differential alarm is calculated in the following cases: if chilling + probe set to evaporator = sensor or if <i>heating</i> + probe set to condenser = sensor	



The oil differential alarm of the compressor (pressure) occurs when the value read by the compressor oil pressure probe minus the minimum circuit pressure is below a specific threshold or when it is generated by the compressor oil pressure switch. In terms of control, a single alarm is generated in both cases. The two alarm causes are, however, separated in the log.

Error signals

Each compressor is linked to the following error signals:

ERROR SIGNALS	NUMBER (per group)	RANGE
Discharge temperature probe error	0/1 (depending on compressor)	0..1
Compressor oil pressure probe error	0/1 (depending on compressor)	0..1



4.7.1 Compressors with capacity steps

The existence of one capacity step level indicates that the compressor's power is supplied at 0%, 50% and 100% of the full power.

The existence of two capacity step levels indicates that power can be supplied at the following percentages: 0%, 33%, 66%, 100%.

The *class C* parameter that specifies the number of capacity steps is:

- *(CP08) COMPRESSOR: NUMBER OF STAGE*



Each capacity step is linked to a digital output of Energy XT. The output is configured during the I/O allocation session of the *Configuration wizard*.

4.7.2 Part Winding

Some *compressors* feature a *part winding* function that enables a soft start of the compressor (i.e. the compressor is not immediately powered on at the maximum of its power).



The *part winding* is used to reduce the torque currents of the compressor motors.

The compressor has two windings that are enabled in two phases:

During power on, only the first winding is enabled.

After 1 second, the control enables the output that controls the second winding in order to allow the compressor to be used at its maximum power.

If the compressor is enabled with the *part winding* function, the following *Class C* parameter must be active:

- *(CP17) COMPRESSOR: STARTING MODE*

And set to 1=CP_IGNITION_PARTWINDING



The *part winding* function is linked to an additional digital output of Energy XT. The output is configured during the I/O allocation session of the *Configuration wizard*.

4.7.3 Selecting the compressor selection algorithm

Compressors: selection algorithms

If several *compressors* are present in the same circuit, their operation can be controlled with two algorithms:

- *Saturation*
The compressor in use is exploited to its maximum power before the second compressor is switched on.
- *Balancing*

All the available *compressors* are switched on simultaneously in a balanced manner.

For further information, see chapter "Selection of *cooling* resources".

If Energy XT is enabled to use a *saturation* algorithm for the *compressors*, the following *Class F* parameter must be active:

- *(SP05) COMPRESSORS' SELECTION LOGIC*

If Energy XT is enabled to use a *balancing* algorithm for the *compressors*, the following *Class F* parameter must be active:

- *(SP05) COMPRESSORS' SELECTION LOGIC*

If Energy XT is enabled to use both selection algorithms (see parameters described above), the following *Class C* parameter must be active:

- *(SP05) COMPRESSORS' SELECTION LOGIC*

This parameter specifies the algorithm that must be enabled after the powering on of the system.

4.7.4 Compressor safety

Energy XT enables to control *compressors* equipped with special pressure and *temperature sensors*.

Pressure sensors

The compressor can be controlled by means of two *Class F* parameters that specify whether the compressor has an analogue and/or digital pressure sensor:

- [\(CP16\) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE](#)
- [\(CP18\) COMPRESSOR: OIL PRESSURE DIGITAL INPUT PRESENCE](#)



The pressure sensor is typically used for differential alarms. Therefore, the condenser and evaporator of the sensor must be equipped with suitable pressure sensors.



If present, the pressure sensor is linked to an analogue input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

Class F parameter that specifies whether a digital pressure sensor is present.

Temperature sensors

The compressor can be controlled by means of two *Class F* parameters that specify whether the compressor has an analogue and/or digital *temperature sensor*.

Class F parameter that specifies the type of sensor used to monitor the compressor's discharge temperature alarm:

- [\(CP14\) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE](#)



If the compressor is not equipped with this sensor, set the parameter to "no_sensor".



If used, the pressure sensor is linked to a digital input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

Class F parameter that specifies whether a digital *temperature sensor* is used to monitor the compressor's discharge temperature alarm:

- [\(CP15\) COMPRESSOR: THERMAL ALARM DIGITAL INPUT PRESENCE](#)



If used, the digital *temperature sensor* is linked to a digital input of Energy XT. The input is configured during the I/O allocation session of the [Configuration wizard](#).

4.7.5 Compressor swap

The Swap function is useful to optimize the life cycle of *compressors*.

This function automatically specifies which compressor has to be used depending on the total number of hours of operation.



This function is useful to balance the oil in the circuit and the hours of operation of *compressors*.

The *Class C* parameter that specifies whether the Swap function must be active is:

- [\(CP19\) COMPRESSOR: ENABLE COMPRESSORS SWAP](#)

The *Class H* parameter that defines the swap start time is:

- [\(CP04\) COMPRESSOR: SWAP SINGLE COMP. ON MAX TIME](#)

In ordinary operating conditions (i.e.: the system is not in the power off phase, there are no active alarms), one of the circuit's *compressors* has been running for more than the time specified by parameter [\(CP04\) COMPRESSOR: SWAP SINGLE COMP. ON MAX TIME](#) and one of the *compressors* has been in Off status for more than the time specified by parameter [\(CP04\) COMPRESSOR: SWAP SINGLE COMP. ON MAX TIME](#), with a number of hours of operation below that of the running compressor, the two *compressors* are swapped. In other words, the first one switches off while the second one switches on. The compressor to be switched on must be selected according to the standard selection policies. For further information, see Selection of [cooling](#) resources.



The *compressors* with an active [\(CP20\) COMPRESSOR: MULTISTAGE COMP. ENABLE](#) parameter (*Max. time with reduced power*) cannot be swapped.



The swap function cannot be enabled when the [Free cooling](#), [Pump down](#), alarms and power on/off are active. The function cannot be enabled if there is only one compressor in the circuit.

4.7.6 Compressor timing

The compressor power on and off operations should be compliant with the safety times set by the user using the parameters described below.

Off/on timing

The interval between the power on and off of a single compressor must be equivalent to the safety interval (compressor power on and off safety interval), is specified by the following *Class H* parameter:

- [\(CP02\) COMPRESSOR: OFF-ON COMPRESSOR DELAY](#)



This is the time that must elapse even during the power on of Energy XT.

On/off timing

This is the minimum time during which the compressor must run after power on (before it can be powered off) and is specified with the following *Class H* parameter:

- [\(CP03\) COMPRESSOR: ON-OFF COMPRESSOR DELAY](#)

On/On timing

This is the minimum interval of time that must elapse between two power on operations of a compressor and is specified by the following parameter:

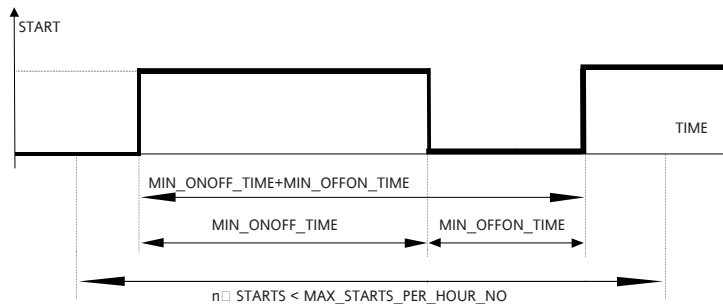
- [\(CP02\) COMPRESSOR: OFF-ON COMPRESSOR DELAY](#) + [\(CP03\) COMPRESSOR: ON-OFF COMPRESSOR DELAY](#)

Max starts per hour

The maximum number of compressor starts per hour is specified by the following *Class H* parameter:

- *(CP09) COMPRESSOR: MAX NUM OF STARTS PER HOUR*

For further information, see the diagram.



START : Compressor power on	TIME: Time
-----------------------------	------------

Capacity step timing

4.7.7 Compressor timings with capacity steps

If the *compressors* have capacity steps, the following *Class H* parameters must be active:

- *(CP10) COMPRESSOR: MIN DELAY BETWEEN TWO STEPS (ON-OFF)*
This parameter determines the minimum time during which a compressor must supply the preset power before reducing it by one level.
- *(CP11) COMPRESSOR: MIN DELAY BETWEEN TWO STEPS (OFF-ON)*
This parameter specifies the minimum time during which a compressor must supply the preset power before reducing it by one level.



If the *compressors* do not have capacity steps, it is necessary to use parameters *(CP03) COMPRESSOR: ON-OFF COMPRESSOR DELAY* and *(CP02) COMPRESSOR: OFF-ON COMPRESSOR DELAY*.

- *(CP20) COMPRESSOR: MULTISTAGE COMP. ENABLE*
This *Class C* parameter enables to record for how long the compressor has been operating with an active capacity step.



This function reciprocally protects the *compressors with capacity steps* enabling the temperature control circuit to stabilize.

Max. time with reduced power

If parameter *(CP20) COMPRESSOR: MULTISTAGE COMP. ENABLE* is active, the following *class H* parameters apply:

- *(CP05) COMPRESSOR: MAX TIME @ PARTIAL POWER*
This parameter specifies the maximum time during which a compressor can run with reduced power. If a compressor runs at a lower power for more than the time specified by this parameter, the compressor is set to the maximum power for the same interval of time specified by parameter *(CP06) COMPRESSOR: MIN TIME @ PARTIAL POWER*.
- *(CP06) COMPRESSOR: MIN TIME @ PARTIAL POWER*
This parameter specifies the minimum time during which a compressor must operate at maximum power after running at reduced power (for a time equivalent to the interval of time specified by parameter *(CP05) COMPRESSOR: MAX TIME @ PARTIAL POWER*).



The operation at reduced power cannot be enabled when *functions Free cooling*, maximum power on time and defrosting are active.



The capacity step function enables to reduce the number of power on/off operations of *compressors*, which influences their life cycle, and of using *cooling* resources more effectively.

The capacity step valves enable to bypass the gas to some of the mechanical components of the compressor, thus reducing its flow rate (by an amount that varies according to the characteristics of the compressor and the number of valves present; this amount is called step).

The reduced power enables semi-sealed *compressors* to recover oil from the *cooling* circuit.



If alarms are active, the time count is interrupted and resumed after the alarm has ceased.

4.7.8 Advanced ignition policy

The following parameters apply:

- *(AD03) ADVANCED COMP SELECTION LOGIC: ENABLE*
This *Class C* parameter specifies whether Energy XT supports the *advanced ignition policy*.
- *(AD01) ADVANCED COMP SELECTION LOGIC: COMPRESSORS STARTS WEIGHT*
Class H parameter that specifies the weight that has to be assigned to the number of compressor starts if the *advanced ignition policy* is applied.
- *(AD02) ADVANCED COMP SELECTION LOGIC: TIME WEIGHT*
Class H parameter that specifies the weight to be assigned to the time of use of a compressor if the *advanced ignition policy* is applied.

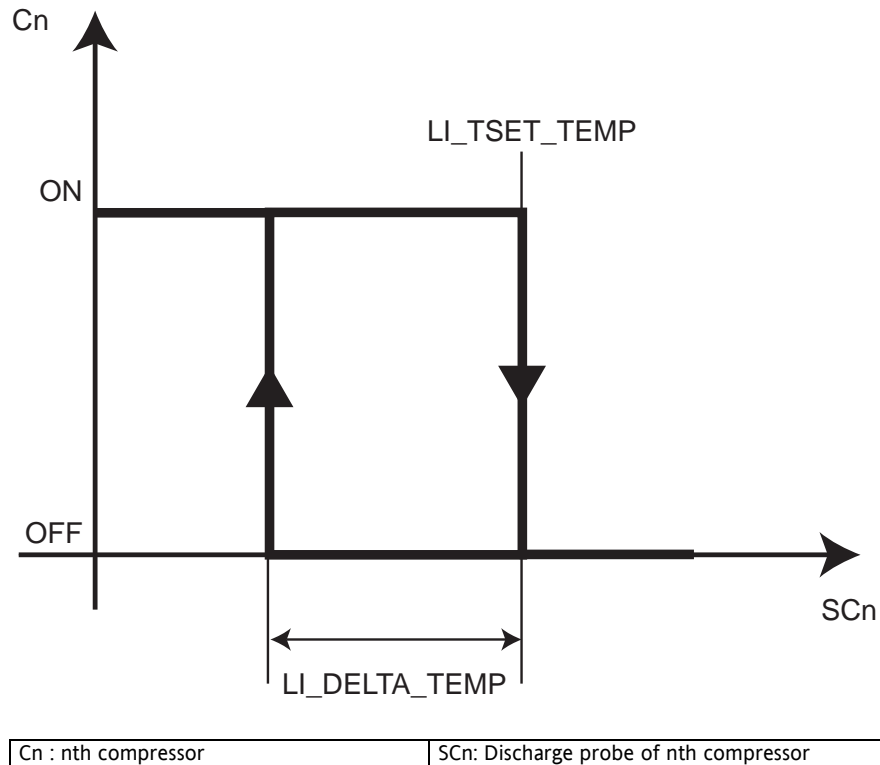
4.7.9 Cooling control of the compressor's discharge temperature (liquid injection) -

To control the function, it is necessary to allocate an injection actuation relay to each compressor.

Applicable parameters are:

- [\(CP25\) COMPRESSOR: LIQUID INJECTION DIGITAL OUTPUT PRESENCE](#) (class F)
This parameter physically allocates the actuation relays (=1 Allocated relays; =0 Non allocated relays).
- [\(CP26\) COMPRESSOR: LIQUID INJECTION ENABLE](#) (class C)
This parameter enables the injection function (=1 Enabled control; =0 Disabled control)-
- [\(CP27\) COMPRESSOR: LIQUID INJECTION TEMPERATURE SET POINT](#) (class C)
Injection enabling [set point](#).
- [\(CP28\) COMPRESSOR: LIQUID INJECTION HYSTERESIS](#) (class C)
Injection enabling delta.

For further information, refer to the diagram below:



The function cannot be enabled if the following [Class C](#) parameter is active:

- [\(CP21\) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE](#)=0 (see [Diagnostics](#))

Or, in other words, if the temperature probe is not present on the condenser.

Relays are always off if the :

- Unit is off
- Compressor is disabled
- Compressor is in alarm mode

4.7.10 Star/delta start with open transition

The start and the star/delta switching occur in two phases:

- 1st Stage: the motor with star connection and running with the power below that of the mains is gradually accelerated with a reduced current and torque.
- 2nd Stage: when the rated speed is reached, the star connection is eliminated before it switches to the delta connection after a short interval of time.

The motor is powered with the rated voltage and resumes the original torque characteristics.

SYSTEM COMPONENTS

The following components are necessary for a star/delta connection:

- 1 Star relay (KM1)
- 1 Line relay (KM2)
- 1 Delta relay (KM3)
- 1 Timer for the power on sequence duration (N_ [\(CG20\) DELTA START T1](#))
- 1 Timer for the switching time duration (N_ [\(CG21\) DELTA START T2](#))

To enable this function, the following parameter:

- (CP17) COMPRESSOR: STARTING MODE

Must be set to CP_IGNITION_STAR_TRIANGLE.

START SEQUENCE

When a compressor start request is received, KM1 (blank) and KM2 close.

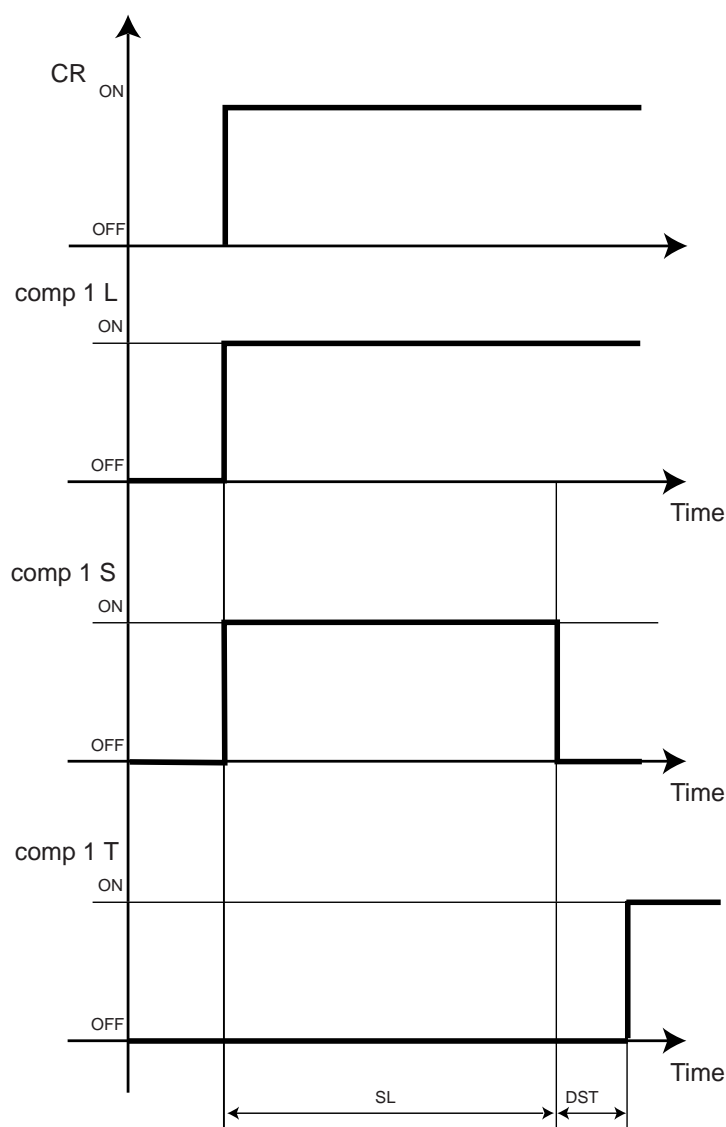
Timer (CG20) DELTA START T1 starts counting the start time with the motor configured in a star connection.

(CG20) DELTA START T1 determines the acceleration time of the motor, which must be in the range of 1.0 ÷ 60.0s and varies in function of the time required to reach a value close to the rated speed of the motor. After this interval of time has elapsed, KM1 opens and relay KM3 closes with a delay of (CG21) DELTA START T2 ms [50÷250ms] (transition time). The transition time cannot be changed.

The transition time enables to remove the electric arc on the star contactor and prevents the occurrence of a short circuit after the closing of the star contactor, though limited by the resistance of the arc. An interval of time above 250ms causes the deceleration of the motor with consequent current peaks during switching. When KM2 and KM3 are closed, the running motor is the one with a star connection.

To be able to guarantee the required response time, it is not possible to allocate more than 5 compressors if the star/delta power on function is enabled. This ensures that all the relays controlling the star and delta windings are allocated in function of the base unit.

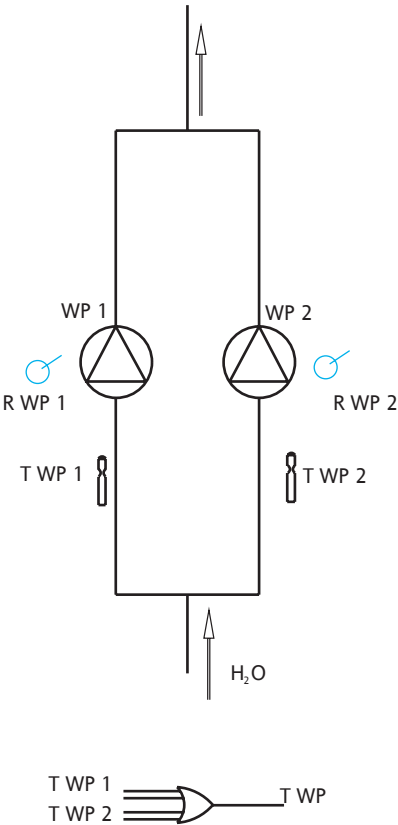
For further information, refer to the diagram below:



comp 1 L : Compressor line (KM2)	comp 1 S : Star of compressor 1 (KM1)	comp 1 T : Delta of compressor 1 (KM3)
SL : Star duration	DST : Star/Delta interval	Time: Seconds/10
CR: Compressor request		

4.8 Pump group

Example of *pump group*:



WP 1,2: Water pump 1,2	T WP 1,2: Thermal switch of water pump 1,2
R WP 1,2: Relay of water pump 1,2	T WP: Thermal switch of water pump

Linked components

Each *pump group* can be linked to the following components:

	NAME	NUMBER (per group)	RANGE
COMPONENTS	Pump	1/2	
ACTUATORS	Relay of water pump	1/2	0..1
PROBES	Thermal switch of water pump	1/2	0..1

Alarms

Each *pump group* can be linked to the following alarms:

ALARM SIGNALS	NUMBER (per group)	RANGE
---------------	--------------------	-------

Thermal switch alarm of water pump	1/2	0..1
------------------------------------	-----	------

If Energy XT is enabled to use a *pump group*, the following *Class F* parameter must be active:

- (SY12) *PUMP GROUP ENABLE*

The number of pumps of the system can be controlled with the following *Class C* parameter:

- (SY10) *PUMPS NUMBER* (max 2)

4.8.1 Control functions of the pump group

Energy XT is able to control the *pump group* in three different ways:

- Group: the controller manages the pumps at a group level and sends a group power on/off signal.
- Individual: the controller powers the single pumps on and off.
- Independent: no pumps are present or the pumps are not managed by the controller. In this case, the controller only receives the flow switch alarm.

If Energy XT is enabled to control the *pump group* with the group mode, the following *Class F* parameter must be active:

- (PP11) *PUMPGROUP: CONTROL TYPE*

If Energy XT is enabled to control the *pump group* with the individual mode, the following *Class F* parameter must be active:

- (PP11) *PUMPGROUP: CONTROL TYPE*

If Energy XT is enabled to control the *pump group* with the independent mode, the following *Class F* parameter must be active:

- (PP11) *PUMPGROUP: CONTROL TYPE*

The active modes can be selected with the following *Class C* parameters:

- (PP11) *PUMPGROUP: CONTROL TYPE*

Individual

If the pumps run in Individual mode, the following parameters must apply:

- (PP10) *PUMPGROUP: PUMP ROTATION TIME*
Class C parameter that specifies the pump rotation time.
This parameter specifies for how long the pump must run before the control switches to another pump.
- (PP12) *PUMPGROUP: COMP STOP ON PUMP ROTATION ENABLE*
Class C parameter specifies whether the *compressors* must be stopped when the pumps are swapped.
- (PP01) *PUMPGROUP: COMP STOP DELAY ON PUMP ROTATION*
Class C parameter that specifies for how long the *compressors* must be stopped after the pumps have been swapped.

4.8.2 Pump group timing

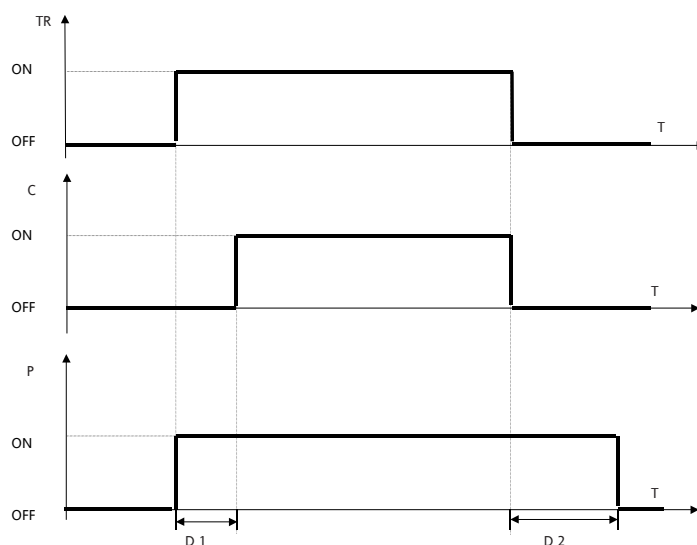
Energy XT enables to control the pump starts/stops in function of the *compressors* by means of the following parameters:

- (PP02) *PUMPGROUP: PUMP ON - COMPRESSORS ON DELAY*
Class C parameter that specifies the delay between the start of the pumps and the start of the *compressors*.



This parameter enables the pumps to start circulating the fluid before the start of the system.

- (PP03) *PUMPGROUP: COMPRESSOR OFF - PUMP OFF DELAY*
Class C parameter that defines the delay between the stops of the *compressors* and pumps.
This parameter specifies for how long the pumps must continue to run after the system has been stopped.



For further information, refer to the diagram below:

TR: Temperature control	C: Compressor
P: Pump	T: Time



D1: Delay between the pump and compressor starts

D2: Delay between the compressor and pump stops

The delays referred to above are met both during the individual and continuous modes and must be met even when the system switches from the **standby** to the remote off modes and vice versa.

"Pump On Call" function

For a more articulated control, it is possible to subordinate the operation of the pumps to that of the **compressors**. The following parameters apply:

- **((PP13) PUMPGROUP: PUMP ON DEMAND ENABLE) PUMPGROUP: PUMP ON DEMAND ENABLE**
Class C parameter that defines the enabling time of function "Pump On Call".
Pumps are powered on only when a compressor start request is received.
- **((PP05) PUMPGROUP: COMPRESSOR OFF - PUMP OFF DELAY (ON DEMAND))**
Class C parameter that defines the delay between the stops of the **compressors** and pumps.
This parameter specifies for how long the pump should run after the **compressors** have been stopped.
- **((PP04) PUMPGROUP: PUMP ON - COMPRESSORS ON DELAY (ON DEMAND))**
Class C parameter that defines the delay between the starts of the pumps and of the **compressors**.
This parameter specifies for how long the pump should run before the first compressor of the system is started. This enables the pumps to pump all the fluid before the **compressors** start the temperature control function.



It is useful to notice that parameters **((PP02) PUMPGROUP: PUMP ON - COMPRESSORS ON DELAY)** and **((PP03) PUMPGROUP: COMPRESSOR OFF - PUMP OFF DELAY)** always adjust the start/stop delays in connection with the system.

4.8.3 Hydraulic pump not managed directly by the controller

If **((PP11) PUMPGROUP: CONTROL TYPE)** = INDEPENDENT, the pump is not controlled directly by the dedicated output of the controller. because the pump is controlled independently from the controller.
The system does, however, control the flow switch.

4.8.4 Pump control: a few examples

The following **table** illustrates some pump operation and control examples along with the related alarms. For further information, see Controlling flow switch alarms.

With one pump or controlled group	<ul style="list-style-type: none"> • The timer used to bypass the flow switch alarm after power on enables. Maximum duration of bypass ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME (C)) • The pump disables and the machine stops if the pump thermal switch enables. • The pump disables and the machine stops if the flow switch alarm enables.
With two pumps or standalone control	<ul style="list-style-type: none"> • The timer used to bypass the flow switch alarm after power on enables. Maximum duration of bypass ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME (C)) • The pump with the lowest number of hours of operation starts. If all the pumps have the same number of hours of operation, the system always chooses pump 1. • The pumps swap if a time band is enabled or if an alarm occurs. Timer ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME (C)) resets. • If the flow switch alarm bypass interval has elapsed and the alarm continues to be active for the interval of time specified by parameter ((PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME(C)), pumps switch and timer is reset with value ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME (C)). The compressors are switched off and the pump/compressor delay is loaded. If the pump is not available, the flow switch alarm is enabled (with automatic reset), the unit is switched off and the pump that was on continues to run. If another pump is available, the alarm ceases and a pump fault alarm (with manual reset) occurs. • If the flow alarm persists, the flow switch alarm enables for a time equivalent to ((PP06) PUMPGROUP: FLOW SWITCH ALARM AUTO->MAN TIME) PUMPGROUP: If FLOW SWITCH ALARM AUTO -> MAN TIME, the device stops along with the rotation of the pumps. • The cancellation of a flow switch alarm with automatic reset occurs if the alarm is not active for an interval of time above the value specified by parameter ((PP09) PUMPGROUP: FLOW SWITCH ALARM EXIT TIME (C)).

4.8.5 Forcing pumps in test mode

If the unit is off, it is possible to force the pumps from the keyboard in test mode.

If enabled, this function is disabled when:

The configuration mode is selected

- The unit is powered on (system ON)
- The mode is switched (**Heating/Cooling**)
- The system is powered on from the line



This function helps installers to clean the hydraulic circuit.

4.9 Probe configurability

It is possible to select whether to include/exclude the following probes by means of the following **Class F** parameters:

- PRC Pressure probe on condenser side

Types of probes



- ((CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE && CIRCUIT_INV_PRES_SENSOR_FLAG)
PRE Pressure probe on evaporator side
- ((CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE && CIRCUIT_INV_PRES_SENSOR_FLAG)
PRMAX Maximum circuit pressure probe
- ((CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE && !CIRCUIT_INV_PRES_SENSOR_FLAG)
PRMIN Minimum circuit pressure probe
- ((CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE && !CIRCUIT_INV_PRES_SENSOR_FLAG)
IDH High pressure digital input (CIRCUIT_HIGH_PRES_DI_FLAG)
- IDL Low pressure digital input (CIRCUIT_LOW_PRES_DI_FLAG)
- STC Temperature probe on condenser ((FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE)

NOTE: PRC and PRE bypass PRMAX and PRMIN, depending on the fixed parameter CIRCUIT_INV_PRES_SENSOR_FLAG selectable from wizard. It is useful to notice that if PRC and PRE are present, they respectively represent the maximum and minimum pressure probes in Chiller mode, which are reversed for the pump. If PRMAX and PRMIN are present, the maximum and minimum circuit pressures are fixed.

It is also possible to configure the following dedicated inputs:

- IDFC Dedicated digital input for fan control ((FP07) FANS: TEMPERATURE DIGITAL INPUT DEDICATED FOR FANS PRESENCE)
- STHR Dedicated temperature probe for recovery ((HR11) HEAT RECOVERY: TEMPERATURE SENSOR PRESENCE)
- IDHR Dedicated digital input for *heat recovery* output ((HR12) HEAT RECOVERY: PRESSURE DIGITAL INPUT PRESENCE)
- IDPD Dedicated digital input for *pump down* ((PD08) PUMPDOWN: PRESSURE DIGITAL INPUT PRESENCE)

It is also possible to add an additional probe to control *defrost* (temperature or pressure, depending on the control mode selected) and provide as input value to the controller the arithmetical average of the value read with the probe without the additional one.

- PRDF Dedicated temperature probe for *defrost* ((DF13) DEFROST: CONDENSER DF ADDITIONAL PRESS SENSORS ENABLE)
- STDF Dedicated pressure probe for *defrost* ((DF12) DEFROST: CONDENSER DF ADDITIONAL TEMP SENSORS ENABLE)



Additional probes are useful to manage units with condenser that have a length of several meters and that must therefore have several temperature (pressure) probes in order to provide more accurate readings of the whole condenser.

4.9.1 Probe configuration

The following tables summarize all the possible configurations of the probes for each temperature regulation algorithm, depending on parameter CIRCUIT_INV_PRES_SENSOR_FLAG.

The lines refer to algorithms, while the columns refer to the probe specified above (the special column "Dedicated probe" is used only for the names of specific probes). Every line of the *table* lists all the options available for the regulator (a line per probe is used).

Table
with active probe
reversal

• CIRCUIT_INV_PRES_SENSOR_FLAG=TRUE

Control	PRC	PRE	STC	IDH	IDL	Dedicated probe	Enabling	Probe selection	Remarks
Chiller/Pump pressure fans control	X					IDFC	Always On	(FF02) FANS: CONTROL SENSOR (T/P) condenser_Pressure_sensor condenser_temperature_sensor condenser_pressure_di	
Chiller/Pump temperature fans control			X				Always On		
High pressure – Chiller analogue output	X						If PRC* is present	N/A	
High pressure – Pump analogue output		X					If PRE* is present		
Low pressure – Chiller analogue output		X					If PRE** is present		
Low pressure – Pump analogue output	X						If PRC** is present		
High pressure – Chiller/pump digital output				X			If IDH* is present		
Low pressure – Chiller/Pump digital output					X		If IDE** is present		
Defrosting temperature input			X			STDF (Average)	(DF19) DEFROST: TYPE	(DF20) DEFROST: START SENSOR TYPE (DF21) DEFROST: END SENSOR TYPE condenser_temperature_sensor condenser_Pressure_sensor defrost_temperature_sensor defrost_pressure_sensor	STDF is optional
Defrosting pressure input	X					PRDF (Average)			
Defrosting temperature input			X			STDF (Average)			
Defrosting pressure output	X					PRDF (Average)			
Oil pressure differential alarm on chiller		X				PRCPR	(CP22) COMPRESSOR: DIFFERENTIAL ALARM ENABLE	N/A	Both probes required
Oil pressure differential alarm on pump	X								
Oil pressure switch of chiller/pump compressor						IDPCPR	(CP24) COMPRESSOR: OIL PRESSURE DIGITAL INPUT ALARM PRESENCE	N/A	
Compressor discharge temperature alarm						IDTCPR / STTCPR	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE	(CP14) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE	One or other probe must be used
Compressor motor temperature alarm						STCPR	(CP23) COMPRESSOR: THERMAL ALARM ENABLE	N/A	
Chiller pump down analogue output		X					(PD05) PUMPDOWN: TYPE	(PD06) PUMPDOWN: SENSOR T/P pressure_sensor pressure_di pd_pressure_di	
Pump pump down analogue output	X								
Digital pump down output					X	IDPD			
Digital input for pressure recovery (forced output status: high pressure)	X					IDHR	(HR14) HEAT RECOVERY: ENABLE	HR_TEMPERATURE_SENSOR condenser_temperature_sensor	
Recovery (input status: temperature)			X			STHR		hr_temperature_sensor (HR08) HEAT RECOVERY: SENSOR condenser_Pressure_sensor hr_pressure_sensor	

Table
Fixed probes

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Control	PRMAX	PRMIN	STC	IDH	IDL	Dedicated probe	Enabling	Probe selection	Remarks
Chiller/Pump pressure fans control	X					IDFC	Always On	(FF02) FANS: CONTROL SENSOR (T/P) condenser_Pressure_sensor condenser_temperature_sensor condenser_pressure_di	
Pump pressure fans control		X							
Chiller/Pump temperature fans control			X						
High pressure – Chiller/pump analogue output	X						If PRMAX* is present	N/A	
Low pressure – Chiller/Pump analogue output		X					If PRMIN** is present		
High pressure – Chiller/pump digital output				X			If IDH* is present		
Low pressure – Chiller/Pump digital output					X		If IDE** is present		
Defrosting temperature input			X			STDF (Average)	(DF19) DEFROST: TYPE	(DF20) DEFROST: START SENSOR TYPE (DF21) DEFROST: END SENSOR TYPE condenser_temperature_sensor condenser_Pressure_sensor defrost_temperature_sensor defrost_pressure_sensor	STDF is optional
Defrosting pressure input		X				PRDF (Average)			
Defrosting temperature input			X			STDF (Average)			
Defrosting pressure output		X				PRDF (Average)			
Chiller/Pump oil pressure differential alarm		X				PRCPR	(CP22) COMPRESSOR: DIFFERENTIAL ALARM ENABLE	N/A	Both probes required
Oil pressure switch of chiller/pump compressor						IDPCPR	(CP24) COMPRESSOR: OIL PRESSURE DIGITAL INPUT ALARM PRESENCE	N/A	
Compressor discharge temperature alarm						IDTCPR / STTCPR	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE	N/A	One or other probe must be used
Compressor motor temperature alarm						STCPR	(CP23) COMPRESSOR: THERMAL ALARM ENABLE	N/A	
Chiller/pump <i>pump down</i> analogue output		X					(PD05) PUMPDOWN: TYPE	(PD06) PUMPDOWN: SENSOR T/P pressure_sensor pressure_di pd_pressure_di	
Digital <i>pump down</i> output					X	IDPD			
Digital input for pressure recovery (forced output status: high pressure)	X					IDHR	(HR14) HEAT RECOVERY: ENABLE	HR_TEMPERATURE_SENSOR condenser_temperature_sensor	
Recovery (input status: temperature)			X			STHR		hr_temperature_sensor (HR08) HEAT RECOVERY: SENSOR condenser_Pressure_sensor hr_pressure_sensor	

- CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE

* One of the three must always be preset (see Probe limits)

** One of the three must always be preset (see Probe limits)

4.9.2 Probes on compressors

- IDCPR Compressor temperature digital input ((CP15) COMPRESSOR: THERMAL ALARM DIGITAL INPUT PRESENCE)
- PRCPR Compressor oil pressure probe ((CP16) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE)
- IDPCPR Oil differential digital input of compressor ((CP18) COMPRESSOR: OIL PRESSURE DIGITAL INPUT PRESENCE)
- IDTCPR Discharge temperature digital input ((CP14) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE)
- STTCPR Discharge temperature probe ((CP14) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE) in replacement of IDTCPR

4.9.3 Probe limitations

The following main limitations apply.

The system must have at least one sensor (probe or digital input) for high pressure and another sensor (probe or digital input) for the low pressure.

The oil pressure sensor of the compressor (PRCPR) can be present only if a "suitable" pressure probe is present in the system. In other words if CIRCUIT_INV_PRES_SENSOR_FLAG=1:

For chillers: PRCPR can be present only if a pressure probe is present on the evaporator side.

For heat pumps: PRCPR can be present only if a pressure probe is present on the condenser side.

For reversible units: PRCPR can be present only if both pressure probes are present (on the evaporator and condenser sides).

If CIRCUIT_INV_PRES_SENSOR_FLAG=0, a minimum circuit pressure probe must be present.



The I/O map is linked to the configuration of physical probes (but not to the selection of control algorithms). Therefore, if probe STCPR is selected, the I/O map will allocate an input regardless of the fact that the "compressor motor temperature alarm" algorithm is enabled or disabled.

5 RESOURCES' SELECTION POLICIES

Parameters ((SP03) EVAPORATORS' SELECTION LOGIC, (SP04) CIRCUITS' SELECTION LOGIC, SPO5) enable to select, for each level of the system's components (EVAPORATOR, CIRCUIT, COMPRESSOR), the selection policy that the temperature control must follow to distribute *cooling* resources. The available modes are *saturation* and *balancing*.

These selection policies are mainly based on the hours of operation of *compressors*, though it is also possible to use parameter (AD03) ADVANCED COMP SELECTION LOGIC: ENABLE to configure more complex policies that take into account not only the hours of operation, but also the number of compressor start events. In this case, it is even possible to define the "weight" that has to be assigned to all the elements of the equation.

If the hours of operation are referred to components with a higher hierarchical level as compared to the compressor (CIRCUIT, EVAPORATOR), it is necessary to take into account the *average hours* of operation of the *compressors* that form part of the component.

The minimum *cooling* power unit managed by the temperature control, for sealed and semi-sealed *compressors*, generically referred to as "step", corresponds to a capacity step of the compressor if this has capacity steps or to the compressor itself if there are no capacity steps.

Selection policies are cascade enabled depending on the components of the system. As soon as the temperature control issues a request to enable/disable a step, this is transmitted to the best EVAPORATOR (depending on the configured selection policy – (SP03) EVAPORATORS' SELECTION LOGIC), then to the best EVAPORATOR CIRCUIT (depending on the configured circuit selection policy – (SP04) CIRCUITS' SELECTION LOGIC) and finally to the best CIRCUIT COMPRESSOR (depending on the configured compressor selection policy – (SPO5) COMPRESSORS' SELECTION LOGIC).

5.1 Saturation

Saturation follows the rules listed below, regardless of the components to which it is applied.

1. Staticity: assigned *cooling* resources are not changed if they meet the current request.
2. Increase/decrease requests involving more than one step are managed, within the same control cycle, as increase/decrease sequences of one step (i.e. as if rules 3 and 4 were repeatedly applied).
3. Every time a one step increase is received, the system searches for all the components that could actually provide this increase selecting the one that is closer to its maximum availability value, which represents the maximum number of steps that can be provided for the time specified. If the distance is equivalent, the system selects the component with the lowest number of hours of operation.
4. Every time a one step decrease request is received, the system searches for the components that could actually provide this decrease, selecting the one that is closer to the minimum availability value, which represents the minimum number of steps that can be provided for the time specified. If the distance is equivalent, the system selects the component with the lowest number of hours of operation.
5. Resources are allocated in accordance with the levels of availability of the components controlled. However, in some cases (for example during some types of *defrost* operations) it is necessary to bypass these rules so that resources can be allocated without taking availability into account. In this case, the system takes into account only the minimum/maximum value that can be reached by the component. The values that can be reached by a component represent the availability values that these would supply if all the safety intervals of the component and of its secondary components were equivalent to zero.

Example:

Let's assume that the circuit has 2 *compressors* with 3 capacity steps (i.e. levels 0,1,2,3,4) and that the minimum/maximum availability and reachability level of a component is indicated in square brackets :

- A circuit in alarm mode is available [0,0] and can be reached within the specified *range* [0,0].
- A powered off circuit with *compressors* that cannot be powered on, due to the existence of safety intervals, is available [0,0] and reachable [0, 8]
- A circuit with a compressor powered on at level 2 and another compressor powered off, is available [2,2] and reachable [0,4].

This is obviously true if the requests fall within the limits defined by the sum of the minimum/maximum values that can be reached by the components.

However, there are scenarios in which these rules cause a *saturation* as compared to fixed dynamic limits, thus causing the enabling/disabling of components.

A typical scenario is illustrated below.

Scenario

2 *circuits*, each with 4 *compressors* with configured capacity steps.

Initially, circuit 0 has 2 enabled *compressors*, circuit 1 has 1 enabled compressor and the request is for 3 *compressors*.

When the situation stabilizes, all the 4 *compressors* of circuit 0 are enabled, along with the 2 *compressors* of circuit 1. The request increases to 4.

The rules defined cause a dynamic *saturation*.

Supply	Availability	Request
[0,0]	[[0,2], [0,1]]	3
[1,0]		
[2,0]		
[2,1]		
[2,1]	[[0,4], [0,2]]	4
[2,2](*)		

(*) If the lowest is increased, the level reaches [2,2], with a circuit that is saturated to its full availability (circuit 1). If [3,1] were supplied, none of the *circuits* would be saturated.

A similar scenario could also apply to the decrease rule.

It is also possible to use advanced selection policies, based, for example, on the hours of operation and on the number of starts. See paragraph Advanced start policies for further information.

5.2 Balancing

Balancing follows the rules described below, regardless of the components to which it is applied.

1. Staticity: assigned *cooling* resources are not changed if they meet the current request.
2. Increase/decrease requests that involve more than one step are managed, within the same control cycle, as increase/decrease sequences by one step.
3. Every time a one step increase request is received, the system searches for all the components that could actually provide this increase selecting the one that is closest to its maximum availability value, which represents the maximum number of steps that can be provided for the time specified. If the distance is equivalent, the system selects the component with the lowest number of hours of operation.
4. Every time a one step decrease request is received, the system searches for the components that could actually provide this decrease, selecting the one that is closest to the minimum availability value, which represents the minimum number of steps that can be provided for the time specified. If the distance is equivalent, the system selects the component with the lowest number of hours of operation.
5. Resources are allocated in accordance with the levels of availability of the components controlled. However, in some cases (for example during some types of *defrost* operations) it is necessary to bypass these rules so that resources can be allocated without taking availability into account. In this case, the system takes into account only the minimum/maximum value that can be reached by the component. The values that can be reached by a component represent the availability values that these would supply if all the safety intervals of the component and of its secondary components were equivalent to zero.

The sections that follow describe in detail the effect of the start policies on each component.

5.3 Compressor selection policies

**Saturated
compressor**

A *saturated compressor* is a compressor that is supplying its maximum power (maximum number of steps that can be supplied). If the compressor is configured with capacity steps, the compressor power on level can be viewed as the number of steps that the compressor is supplying (a compressor with 3 capacity steps, for example, will supply a maximum of 4 power on levels/steps).

The requirements for the enabling of steps (increase/decrease) on *compressors* that are part of the same circuit are described below.

5.3.1 Compressor saturation

The *saturation* policy attempts to distribute the resources among the lowest number of *compressors*, compatibly with the limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour.

The resulting allocation ensures that the highest number of *compressors* is always off, compatibly with the limits of other requirements, as described below.

5.3.2 Compressor balancing

The *balancing* policy attempts to equally distribute the resources among the maximum number of *compressors*, compatibly with its limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour.

The resulting allocation ensures, at all times, the most balanced power levels, compatibly with the limits of other requirements, as described below.

The selection policy can be configured with the following *Class C* parameter:

- (SP05) COMPRESSORS' SELECTION LOGIC

5.4 Circuit selection policies

Saturated circuit

A *saturated circuit* is a circuit that is supplying its maximum power (sum of the maximum number of steps that can be supplied by the *compressors* of the circuit). A circuit is active or on if it at least one of its *compressors* has an active step; and off if none of its *compressors* is powered on. The level of *saturation* of a circuit is the sum of the steps that the *compressors* are supplying at a specific time (a circuit with 2 *compressors* and 3 capacity steps can, for example, supply a maximum of 8 capacity levels/steps).

The requirements for the enabling of steps of *circuits* that are part of the same evaporator are described below.

5.4.1 Circuit saturation

The *saturation* policy attempts to distribute the resources among the lowest number of *circuits*, compatibly with the limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour. The resulting allocation ensures that the highest number of *circuits* is always disabled, compatibly with the limits of other requirements, as described below.

5.4.2 Circuit balancing

The *balancing* policy attempts to equally distribute the resources among the maximum number of *circuits*, compatibly with the limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour. The resulting allocation always ensures the most balanced power levels for the *circuits*, compatibly with the limits of other requirements, as described below.

The selection policy can be configured with the following *Class C* parameter:

- *(SP04) CIRCUITS' SELECTION LOGIC*

5.5 Evaporator selection policies

A *saturated* evaporator is an evaporator that is supplying its maximum power (sum of the maximum number of steps that can be supplied by the *circuits* of the evaporator). An evaporator is active or on if it at least one of its *circuits* is active; and off if none of its *circuits* is powered on. The level of *saturation* of an evaporator is the sum of the steps that the *circuits* are supplying at a specific time (an evaporator with 2 *circuits* and 2 *compressors* with 3 capacity steps can, for example, supply a maximum of 16 capacity levels/steps).

The requirements for the enabling of steps of an evaporator that are part of the same system are described below.

5.5.1 Evaporator saturation

The *saturation* policy attempts to distribute the resources among the lowest number of evaporators, compatibly with the limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour. The resulting allocation ensures that the highest number of evaporators is always disabled, compatibly with the limits of other requirements, as described below.

5.5.2 Evaporator balancing

The *balancing* policy attempts to equally distribute the resources among the maximum number of evaporators, compatibly with the limits of other requirements like: safety intervals of *compressors*, maximum number of power on operations per hour.

The resulting allocation always ensures the most balanced power levels for *circuits*, compatibly with the limits of other requirements, as described below.

The selection policy can be configured with the following *Class C* parameter:

- *(SP03) EVAPORATORS' SELECTION LOGIC*

5.6 Advanced start policy

The system now features a special function that enables the regulator to select the compressor to be enabled/disabled according to the number of hours of operation or starts.

Consequently, each time the regulator receives a compressor enabling request, it selects the resource with the lowest number of hours of operation in order to guarantee a more consistent use of the available resources in terms of hours of operation and number of starts.

This function can be enabled with the following *Class C* parameter:

(AD03) ADVANCED COMP SELECTION LOGIC: ENABLE

The user can decide whether to give priority to the number of hours of operation or starts by using the following *Class H* parameters:

(AD02) ADVANCED COMP SELECTION LOGIC: TIME WEIGHT

(AD01) ADVANCED COMP SELECTION LOGIC: COMPRESSORS STARTS WEIGHT

The advanced power on algorithm is local and can be used only for the steps of *compressors* that are part of the same circuit. Its effect on upper levels is indirect only.

The advanced start algorithm follows the rules described below.

If

(AD01) ADVANCED COMP SELECTION LOGIC: COMPRESSORS STARTS WEIGHT * acc_n + 36/25 * *(AD02) ADVANCED COMP SELECTION LOGIC: TIME WEIGHT* * day_n

< (Smaller than)

(AD01) ADVANCED COMP SELECTION LOGIC: COMPRESSORS STARTS WEIGHT * acc_n + 36/25 * *(AD02) ADVANCED COMP SELECTION LOGIC: TIME WEIGHT* * day_n

Then

n is selected

Otherwise

m is selected.

(acc_n and acc_m are the number of starts, day_n and day_m represent the hours of operation and 36/25 is a scaling constant that converts the values from the decimal to the sexagesimal format.

The advanced start policies implies assigning the resources, compatibly with the request, that are able to minimize the expression above.



The example illustrated in this paragraph has been simplified, as the expression takes into account also the hours and minutes of operation.

6 THERMOREGULATION

6.1 Operating mode

Once the configuration is completed, Energy XT can be used to control the *loads* in function of the temperatures and pressures measured by the probes and the temperature control *functions* defined by the user.

There are 3 *operating modes*:

- *Cooling* (summer)
- *Heating* (winter)
- *Standby* (off)

Cooling *Cooling*: this is the "summer" *operating mode*. In this mode the unit is configured to supply cold air.

Heating *Heating*: this is the "winter" *operating mode*. In this mode the unit is configured to supply hot air.

Standby *Standby* (Off): in this mode the unit does not manage the temperature control *functions* and some of the alarm signals continue to be active.

The *operating mode* can be selected:

- From the keyboard
- With a digital input
- In function of the time band



The current *operating mode* can always be displayed on the *user interface* through the Main *Menu*.

Selecting the mode from the keyboard

SELECTING THE MODE FROM THE KEYBOARD

The *operating mode* can generally be set from the keyboard by selecting the *Mode Menu*.

The availability, name and layout of this *menu* vary according to how the user has organized the tree view with tool MenuMaker.

Remote On/Off

REMOTE ON/OFF

If the following *Class F* parameter is active:

- *(SP09) REMOTE OFF INPUT PRESENCE*

Energy XT uses a digital input to switch the unit on and off (*remote on/off* input).



If the digital input is ON, it is always possible to switch the unit on/off from the keyboard.

If the digital input is OFF, the keyboard mode is disabled.

Remote Heating/Cooling

SELECTING THE COOLING/HEATING MODE (SUMMER/WINTER) REMOTELY

If the unit has been configured as reversible, i.e. if the following *Class F* parameter is active:

- *(SP06) REVERSABLE HEAT-PUMP ENABLE*

If the following *Class F* parameter is active:

- *(SP08) MACHINE REVERSAL REMOTE INPUT PRESENCE*

And if the unit has been configured as reversible with the following *Class C* parameter:

- *(SY11) PLANT TYPE = PLANT_REVERSIBLE*

Energy XT controls the *cooling/heating* (summer/winter) mode by means of a digital input (*cooling/heating* input).

If the unit has been configured as reversible, the following *Class C* parameter:

- *(SP02) UNIT STARTING MODE*

Defines the "mode" selected by the unit after power on (reversible unit). The current *operating mode* (Chiller or Heat pump) is saved in this parameter every time the unit is switched off (Power Off).



If parameter *(SP06) REVERSABLE HEAT-PUMP ENABLE* is active, the only *operating mode* available is the one stored in parameter *(SP02) UNIT STARTING MODE*, as it is not possible to change modes from the keyboard or with a digital or serial input.

6.2 Time bands

The *Time Bands Menu* enables to set the *operating mode* in function of the *time bands* of weekdays.

The availability, name and layout of this *menu* vary according to how the user has organized the tree view with tool MenuMaker.

For each week day it is possible to set up to 4 *time bands* that can be enabled independently; these are used by the system to automatically select the control mode and the related *set point*:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Band 1	Start (hours and minutes) Enable <i>Heating/Cooling set point</i> Mode						
Band 2							
Band 3							
Band 4							

To enable the *time bands*, it is necessary to set to 1 the following *Class H* parameter:



- (CG08) EVENTS ENABLE

And verify that the RTC is present and operating correctly.
When the function is enabled (TIMER=1), the stored value is set to:

- OFF if the unit was off; or to
- LOCAL SET if the unit was already running

In this mode, the operating status of the unit changes only when the next event occurs.

Types of timers

The following 3 *types of timers* are available:

- Daily: independent setting programmed for each day
- Weekly: all week days have the same setting
- "5+2": the settings are always the same, from Monday to Friday and from Saturday to Sunday

The timer can be selected by means of the following *Class H* parameter:

- (CG09) EVENTS TYPE



Time band settings always override the settings configured remotely or from the keyboard.

6.2.1 Time band start time

For each time band, it is possible to specify a start time.

This is expressed in hours and minutes.

Values can be set without any limitation.

In the example, events are programmed to occur in the following order:

Band 1 → Band 3 → Band 2 → Band 4

Band 1	Band 2	Band 3	Band 4
04:00	12:00	11:00	23:00



If 2 or more events have been programmed for the same time band, only the first one will be taken into account.

6.2.2 Enabling a time band

Regardless of the settings, it is possible to enable/disable each phase using the *class H* parameters in the "Time Bands Parameters" folder:

Example:

- Monday
 - Time band 1: (H001) MONDAY EVENT #1 ENABLE
 - Time band 2: (H007) MONDAY EVENT #2 ENABLE
 - ...
- Tuesday
 - Time band 1: (H101) TUESDAY EVENT #1 ENABLE
 - Time band 2: (H107) TUESDAY EVENT #2 ENABLE
 - ...

6.2.3 Time band set point

For each enabled time band and mode – *Heating*, *Cooling* and *Manual* – it is possible to specify a control *set point* with the following *Class H* parameter:

Example:

- Monday
 - (H005) MONDAY EVENT #1 CHILLER SET TEMP
 - (H006) MONDAY EVENT #1 HEATPUMP SET TEMP



The *set point* is *reset* to the default value when the OFF or LOCAL SET modes are active or when the time band control is disabled.

6.2.4 Time band mode

For each time band, the *operating mode* can be selected with the following *Class H* parameter:

- Parameter ??

The available *operating modes* are:

- OFF
- HEATING
- COOLING
- MANUAL
- LOCAL SET

Time band: OFF

The machine is off and the *operating mode* switches to the SUMMER/WINTER SWITCHING digital input, if configured, enabled and active or to the mode configured with the parameter.

The *set point* acquires the original value depending on the configured mode.

Time band: HEATING

The unit runs in *HEATING* mode, regardless of the setting of digital input SUMMER/WINTER SWITCHING or of parameter (CG11) PLANT MODE MANUAL (Manual *Heating/Cooling* mode selection).

The original [set point](#) is copied for backup purposes and the [set point](#) configured in the current band becomes the control [set point](#).

**Time band:
COOLING**

The unit runs in CHILLER mode, regardless of the setting of digital input SUMMER/WINTER SWITCHING or of parameter [\(CG11\) PLANT MODE MANUAL](#) (Manual [Heating/Cooling](#) mode selection).
The original [set point](#) is copied for backup purposes and the [set point](#) configured in the current band becomes the control [set point](#).

**Time band:
MANUAL**

The unit runs normally and the [operating mode](#) selection switches from digital input SUMMER/WINTER SWITCHING, if this is configured, enabled and active or, alternatively, to the mode specified in parameter [\(CG11\) PLANT MODE MANUAL](#).
The original [set point](#) is copied for backup purposes and the [set point](#) configured in the current band becomes the control [set point](#).

**Time band: LOCAL
SET**



The unit runs normally and the [operating mode](#) selection switches from digital input SUMMER/WINTER SWITCHING, if this is configured, enabled and active or, alternatively, to the mode specified in parameter [\(CG11\) PLANT MODE MANUAL](#).
The [set point](#) acquires the original value depending on the configured mode.

To change the [operating mode](#), it is sufficient to switch the unit off within the safety intervals and restart it after setting the new value for the [operating mode](#).

Digital input [REMOTE ON/OFF](#) overrides the [time band mode](#) and determines therefore the status of the system.

If input L is enabled and active, the machine is always off.

If the TIMER function is enabled, the mode of the active time band is saved in the EEPROM so that it can be restored after the new power on.

6.2.5 Copy Settings function

The [Copy Settings function](#) enables to copy the settings of the [time bands](#) of a specific weekday into those of another day. This function is active only if Timer Type is set to Daily mode.

This operation can generally be performed with the "Copy Settings" [Menu](#).

The availability, name and layout of this [menu](#) vary according to how the user has organized the tree view with tool MenuMaker.

Copy [Menu](#)

The Copy [Menu](#) enables to select the source weekday for the data copy operation.

The selected day is highlighted with "Yes".

Copy	1/3
Mon	No
Tue	Yes
Wed	No

Copy	2/3
Thu	No
Fri	No
Sat	No

Copy	3/3
Sun	No



The selected day continues to be displayed even after exiting from the [menu](#).

Paste [Menu](#)

The Paste [Menu](#) enables to copy the selected data to a target day.

Copied weekdays are highlighted with "Yes".

Paste	1/3
Mon	No
Tue	Yes
Wed	No

Paste	2/3
Thu	Yes
Fri	Yes
Sat	No

Paste	3/3
Sun	No

6.3 Temperature control sensors

Temperature can be controlled in function of the temperature of the water output/input from/to the thermodynamic system.

If Energy XT has an input sensor for temperature control, the following [Class F](#) parameter must be active:

- [\(ST08\) DYNAMIC TSET: THERMAL REGULATION SENSOR](#)

If Energy XT has an output sensor for temperature control, the following [Class F](#) parameter must be active:

- [\(ST08\) DYNAMIC TSET: THERMAL REGULATION SENSOR](#)

If both sensors are available, it is possible to specify the parameter that has to be used, after power-on, with the following [Class C](#) parameter:

- [\(ST08\) DYNAMIC TSET: THERMAL REGULATION SENSOR](#)

6.4 Temperature control in Cooling mode

If the temperature is controlled in function of the temperature of the water output from the evaporator, the [set point](#) and proportional band values are determined by the settings of the following [Class H](#) parameters:

Cooling set point

- (MC01) [COOLING: SET POINT](#)

[Cooling set point](#)

The value that can be assigned must [range](#) between the minimum and maximum settings of the following [Class C](#) parameters:

- (MC02) [COOLING: MIN SET POINT](#)
- (MC03) [COOLING: MAX SET POINT](#)

Cooling
proportional band

- [\(MC05\) COOLING: PROPORTIONAL BAND](#)

Specifies the width of the proportional band.

The value that can be assigned must [range](#) between the minimum and maximum settings of the following [Class C](#) parameters:

- [\(MC06\) COOLING: MIN PROPORTIONAL BAND](#)
- [\(MC06\) COOLING: MAX PROPORTIONAL BAND](#)

Some examples are provided in subchapter [Types of temperature control](#)



If temperature is controlled in function of the temperature of the water input to the evaporator, the [set point](#) will be increased by the offset specified by the following [Class H](#) parameter:

- [\(MC04\) COOLING: INLET WATER TEMP OFFSET](#)

Therefore, the temperature control [set point](#) will be:

- (MC01) [COOLING: SET POINT](#) + [\(MC04\) COOLING: INLET WATER TEMP OFFSET](#)



This is done to take into account the thermal variation caused by the evaporator.

Timers

The capacity step enabling/disabling request issued by the temperature control (with the exception of specific cases such as alarms, shutdown, changes in the availability of components) will be carried out only after the minimum time specified by the following [Class H](#) parameter has elapsed:

- [\(MC08\) COOLING: INCREMENTAL STEP TIME](#) (for increase)
- [\(MC08\) COOLING: INCREMENTAL STEP TIME](#) (for decrease)



If simultaneous safety intervals are present, the capacity steps are enabled/disabled after the longest safety interval has elapsed.

6.5 Temperature control in Heating mode

If the temperature is controlled in function of the temperature of the water output from the evaporator, the [set point](#) and proportional band values are determined by the settings of the following [Class H](#) parameters:

Heating set point

- (MH01) [HEATING: SET POINT](#)

[Heating set point](#)

The value that can be assigned is limited by the minimum and maximum settings of the following [Class C](#) parameters:

- (MH02) [HEATING: MIN SET POINT](#)
- (MH03) [HEATING: MAX SET POINT](#)

Heating
proportional band

- [\(MH04\) HEATING: PROPORTIONAL BAND](#)

Specifies the width of the proportional band.

The value that can be assigned is limited by the minimum and maximum settings of the following [Class C](#) parameters:

- [\(MH05\) HEATING: MIN PROPORTIONAL BAND](#)
- [\(MH06\) HEATING: MAX PROPORTIONAL BAND](#)

Some examples are provided in subchapter [Types of temperature control](#)



If temperature is controlled in function of the temperature of the water input to the evaporator, the [set point](#) will be increased by the offset specified by the following [Class H](#) parameter:

- [\(MH09\) HEATING: INLET WATER TEMP OFFSET](#)

Therefore, the temperature control [set point](#) will be:

- (MH01) [HEATING: SET POINT](#) + [\(MH09\) HEATING: INLET WATER TEMP OFFSET](#)



This is done to take into account the thermal variation caused by the evaporator.

Timers

The capacity step enabling/disabling request issued by the temperature control (with the exception of specific cases such as alarms, shutdown, changes in the availability of components) will be carried out only after the minimum time specified by the following *Class H* parameter has elapsed:

- *(MH07) HEATING: INC. STEP TIME* (for increase)
- *(MH08) HEATING: DEC. STEP TIME* (for decrease)



If simultaneous safety intervals are present, the capacity steps are enabled/disabled after the longest safety interval has elapsed.

6.6 Temperature control anomalies

Temperature control functions: anomalies

If the system uses an input and output sensor, the following *Class C* parameter applies:

- *(DG07) ALARMS: EVAPORATOR TEMP ALARM ENABLE*

This parameter enables the temperature anomaly control.

Energy XT measures the temperature difference between the input and output sensors when the system thermally controls its resources. If the system is running, the difference between the input and output temperature is compared with the reference temperature in order to determine whether the system is operating correctly.

Reference temperature is assigned by means of the following *Class H* parameter:

- *(DG01) ALARMS: EVAPORATOR TEMP ALARM SET POINT*

An alarm occurs if the system fails to respond correctly.

The alarm signal is enabled if the anomaly persists continuously for the time interval specified by the following *Class H* parameter:

(DG02) ALARMS: EVAPORATOR TEMP ALARM ALARM BYPASS

6.7 Types of temperature control

There are three *types of temperature control* available:

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

Proportional time control

If Energy XT supports the proportional function, the following *Class F* parameter must be active:

- *(ST07) DYNAMIC TSET: THERMAL REGULATION TYPE*

Time-proportional temperature control

If Energy XT supports the *time-proportional temperature control*, the following *Class F* parameter must be active:

- *(ST07) DYNAMIC TSET: THERMAL REGULATION TYPE*

'PI' temperature control

If Energy XT supports the "PI" function, the following *Class F* parameter must be active:

- *(ST07) DYNAMIC TSET: THERMAL REGULATION TYPE*

The temperature control function can be selected by means of the following *Class C* parameter:

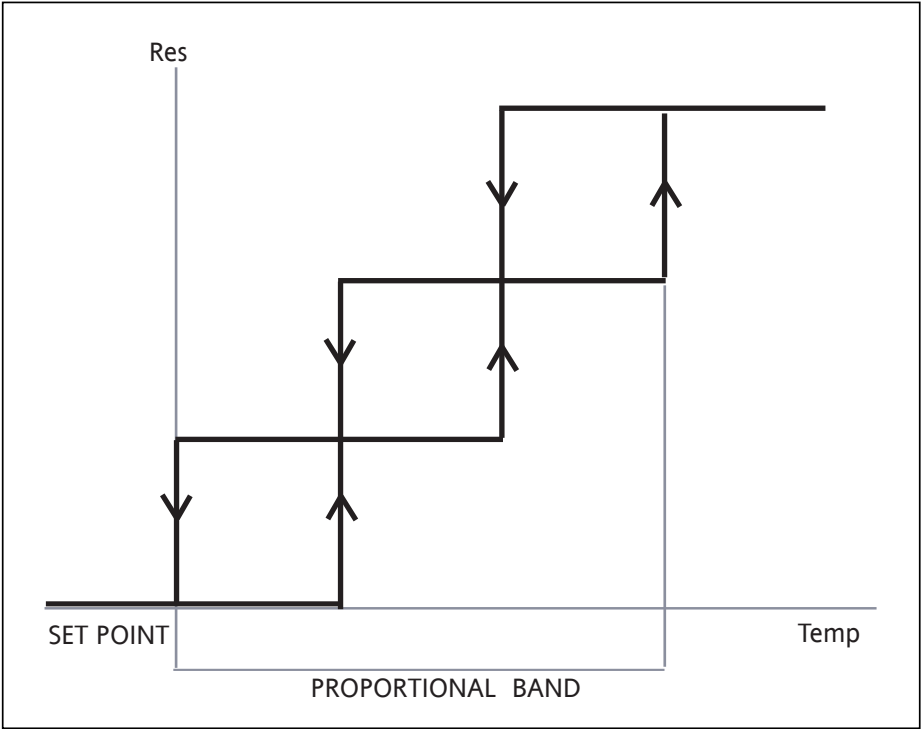
- *(ST07) DYNAMIC TSET: THERMAL REGULATION TYPE*

6.7.1 Proportional temperature control

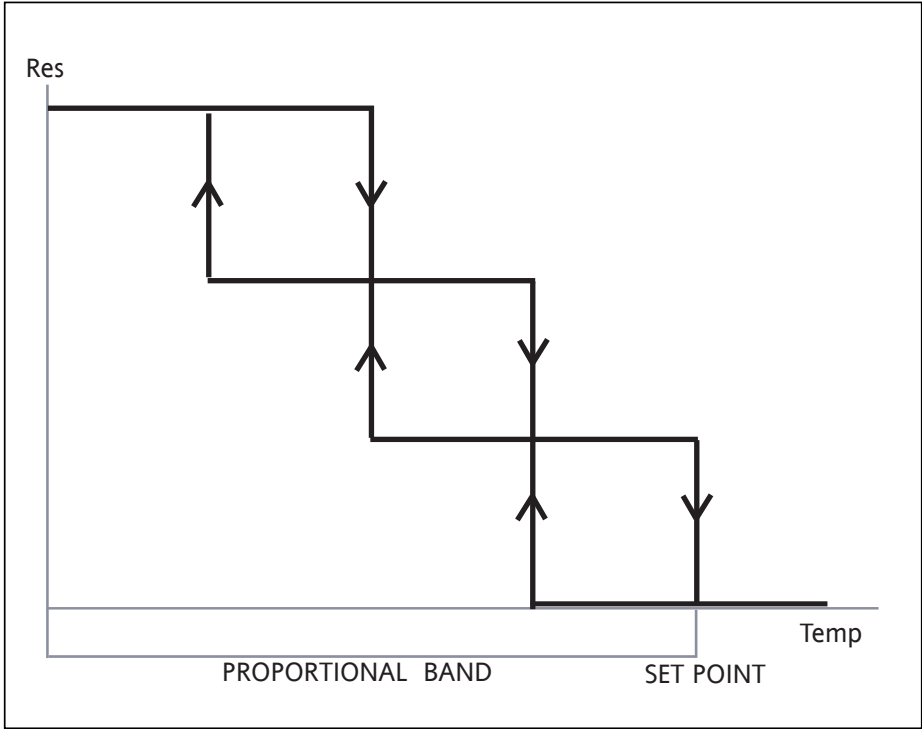
In this mode, the temperature control enables a specific number of *cooling* resources (steps) in order to reach the configured *set point*. The number of resources is determined by the difference between the water temperature and the *set point*. Therefore, the greater the difference and the higher is the number of resources required to reach the *set point*. The temperature *range* between the enabling of two steps varies according to the proportional band and the number of available resources.

The concept is illustrated in greater detail in the following diagrams:

cooling



heating



6.7.2 Time-proportional temperature control

The main function of the temperature control consists in enabling a specific number of resources (capacity steps), which is proportional to the time elapsed from when the control probe has exceeded a specific value called threshold:

Threshold = (MC01) *COOLING: SET POINT + ((MC05) COOLING: PROPORTIONAL BAND / 2). (Cooling)*

Threshold = (MH01) *HEATING: SET POINT + ((MH04) HEATING: PROPORTIONAL BAND / 2). (Heating)*

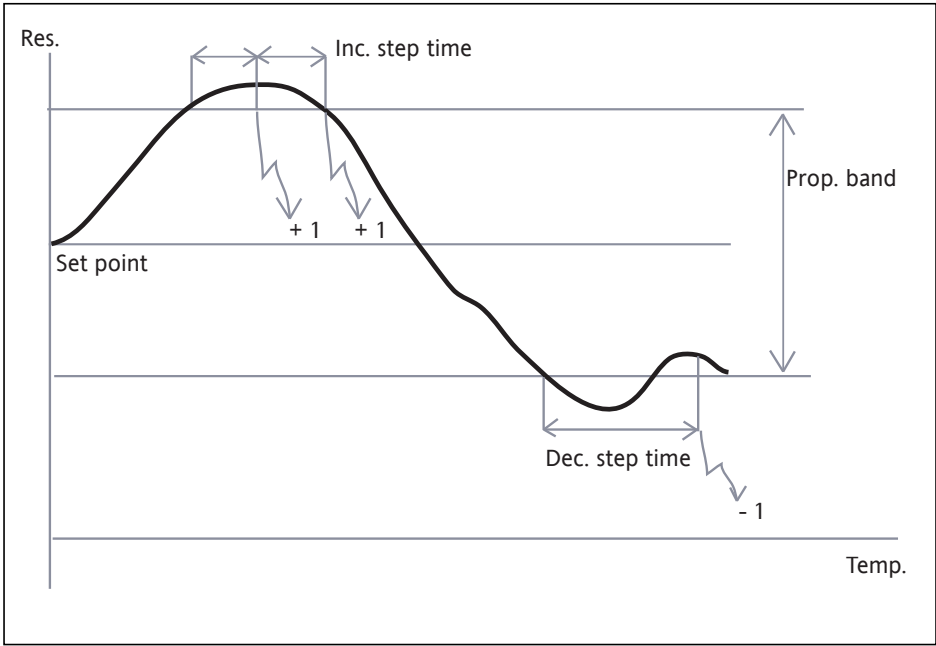
The proportional band is symmetrical to the *set point* value.

When the temperature exceeds the threshold value, after the time specified by parameter (MC08) *COOLING: INCREMENTAL STEP TIME* has elapsed, a capacity step is enabled. The same occurs for the disabling, which occurs after the time specified by parameter (MC09) *COOLING: DECREMENTAL STEP TIME* has elapsed.

There is no *hysteresis* in this algorithm.

This concept is illustrated in greater detail in the following diagram referred to the *Cooling* mode:

Diagram



In the Heat Pump mode, the control, enabling and disabling of capacity steps is reversed as compared to the previous example (-1 replaces +1 in the graph).

6.7.3 PI temperature control

This temperature control is based on the principles of a continuous *PID* control (see [glossary](#)).

This type of control enables to select both the traditional proportional element and an integrative component, as described below.

The proportional component calculates the resources that have to be enabled by taking into account only the error that is present when the control temperature is read (i.e. the difference between the control temperature and the [set point](#)).

The integrative component calculates the resources that have to be enabled taking into account both the error and the sampling time (i.e. the interval between temperature readings, which corresponds to the time needed by the temperature control to calculate the resources that have to be enabled; this time is fixed and cannot be changed by users).

Besides calculating the resources that have to be enabled at the end of a sampling cycle, the integrative component adds the values resulting from the current sampling cycle and the previous one.

This means that if an error is constant in time, the proportional component enables a fixed number of resources, while the integration component increases the resources after each reading (due to the addition effect described above).

An *ARW* filter is used to limit the [saturation](#) of the integrative component.

To configure Energy XT to manage the temperature control with the "PI" function in the linear section, it is necessary to enable the following *Class H* parameter:

- [\(PI03\) TREG-PI: USE PROPORTIONAL COMPONENT](#)

To configure Energy XT to manage temperature control with the "PI" function in the integrative part, it is necessary to enable the following *Class H* parameter:

- [\(PI02\) TREG-PI: USE INTEGRATIVE COMPONENT](#)

If this parameter is used for the integrative component, it is also possible to assign a level of importance with the following *Class H* parameter:

- [\(PI01\) TREG-PI: INTEGRATIVE COSTANT](#)

Parameters

The parameters of the proportional mode are:

- **PB** Proportional band (input variation, in % of its variation [range](#), resulting in a 100% variation of the output)
PB = [\(MC05\) COOLING: PROPORTIONAL BAND](#) (or [\(MH04\) HEATING: PROPORTIONAL BAND](#) for heat pumps)
- **Kp** Proportional gain
- **Kp** = $((CP08) COMPRESSOR: NUMBER OF STAGE + 1) / ((MC05) COOLING: PROPORTIONAL BAND$
(or [\(MH04\) HEATING: PROPORTIONAL BAND](#) for heat pumps)

The parameters added by the integrative component to those of the proportional component are:

- **Ti** Time of integrative component (time [reset](#), [reset](#) rate or doubling time). This corresponds to the time required for the response to the unit step of the integral component to become equivalent to that of the proportional component that is fixed (i.e. the time needed for the PI step to become equivalent to twice the amount of P). In other words, this parameter determines *the variation rate of the power required to attain a null error* or rather the exact equivalence between the [set point](#) and the measured process variable.
1/Ti [Reset](#) rate. This corresponds to the number of doublings within the same time unit.

Ti Corresponds to parameter [\(PI01\) TREG-PI: INTEGRATIVE COSTANT](#).

6.8 Dynamic set point

The regulator can be used to change the [set point](#) automatically according to external conditions.

This is done by adding a positive or negative value (offset) to the [set point](#); this offset changes according to:

- The 4-20 mA analogue input (proportional to a signal specified by the user)

In this case the following *Class F* parameter must be active:

[\(SY14\) DYNAMIC TSET CURRENT SENSOR](#)

Or

- The external temperature of the probe.

In this case the following *Class F* parameter must be active:

[\(SY13\) DYNAMIC TSET EXTERNAL TEMPERATURE SENSOR](#)



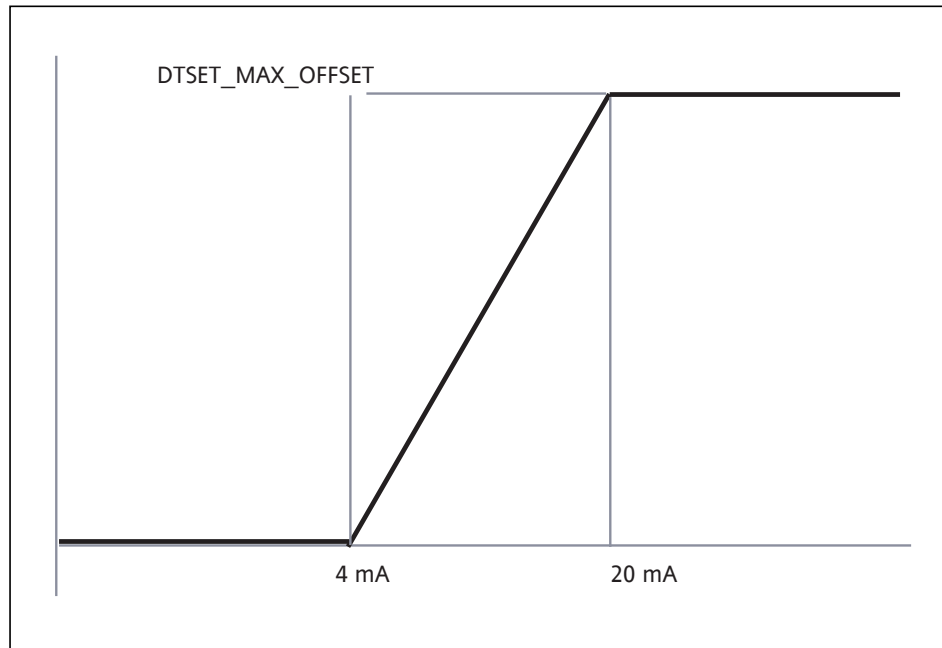
This function has two purposes: to save energy or operate the machine in particularly harsh outdoor temperatures.

The [dynamic set point](#) can be enabled and selected with the following *Class C* parameter:

- [\(ST09\) DYNAMIC TSET: ENABLE](#)

6.8.1 Dynamic set point with current sensor

This control follows the sequence shown in the diagram below.



Dynamic set point: current sensor. The setting of parameter DTSET_MAX_OFFSET to a negative value causes the function to tilt as compared to horizontal axis.
The following parameters apply:

cooling

The **dynamic set point** is controlled by the following three **Class C** parameters:

- (ST01) **DYNAMIC TSET: EXTERNAL TEMP SET FOR COOLING**
Specifies the neutral temperature for the dynamic Tset algorithm
- (ST03) **DYNAMIC TSET: MAXIMUM OFFSET FOR COOLING**
Specifies the maximum offset of the Tset temperature that the dynamic Tset algorithm can generate.
- (ST05) **DYNAMIC TSET: DELTA TEMP FOR COOLING**
Specifies the rate by which the dynamic Tset must change in function of external temperature. Together with parameter (ST03) **DYNAMIC TSET: MAXIMUM OFFSET FOR COOLING** it controls the slope of the dynamic Tset function.

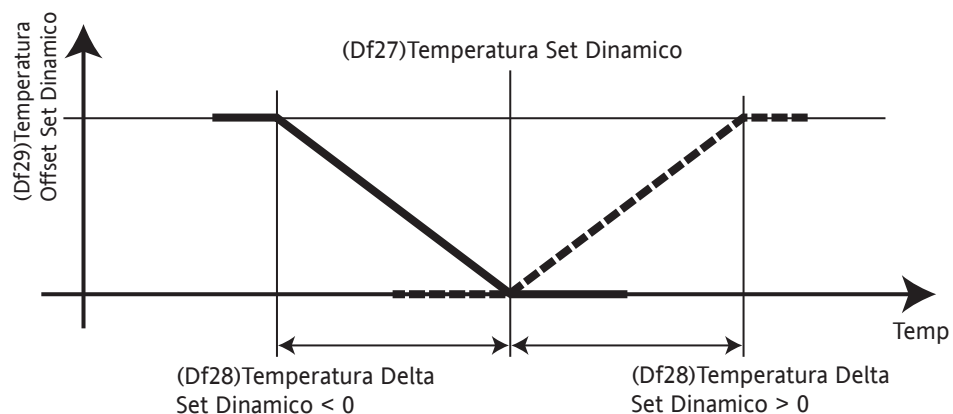
heating

The **dynamic set point** is controlled by the following three **Class C** parameters:

- (ST02) **DYNAMIC TSET: EXTERNAL TEMP SET FOR HEATING**
Specifies the neutral temperature for the dynamic Tset algorithm
- (ST04) **DYNAMIC TSET: MAXIMUM OFFSET FOR HEATING**
Specifies the maximum offset of the Tset temperature that the dynamic Tset algorithm can generate.
- (ST06) **DYNAMIC TSET: DELTA TEMP FOR HEATING**
Specifies the rate by which the dynamic Tset must change in function of external temperature. Together with parameter (ST04) **DYNAMIC TSET: MAXIMUM OFFSET FOR HEATING** it controls the slope of the dynamic Tset function.

6.8.2 Dynamic set point with temperature sensor

This control follows the sequence shown in the diagram below.



The setting of parameter [\(ST04\) DYNAMIC TSET: MAXIMUM OFFSET FOR HEATING](#) to a negative value causes the function to tilt as compared to horizontal axis.

The following parameters apply:

cooling

The *dynamic set point* is controlled by the following three *Class C* parameters:

- [\(ST01\) DYNAMIC TSET: EXTERNAL TEMP SET FOR COOLING](#)
Specifies the neutral temperature for the dynamic Tset algorithm
- [\(ST03\) DYNAMIC TSET: MAXIMUM OFFSET FOR COOLING](#)
Specifies the maximum offset of the Tset temperature that the dynamic Tset algorithm can generate.
- [\(ST05\) DYNAMIC TSET: DELTA TEMP FOR COOLING](#)
Specifies the rate by which the dynamic Tset must change in function of external temperature. Together with parameter DTSET_MAX_OFFSET it controls the slope of the dynamic Tset function.

heating

The *dynamic set point* is controlled by the following three *Class C* parameters:

- [\(ST02\) DYNAMIC TSET: EXTERNAL TEMP SET FOR HEATING](#)
Specifies the neutral temperature for the dynamic Tset algorithm
- [\(ST04\) DYNAMIC TSET: MAXIMUM OFFSET FOR HEATING](#)
Specifies the maximum offset of the Tset temperature that the dynamic Tset algorithm can generate.
- [\(ST06\) DYNAMIC TSET: DELTA TEMP FOR HEATING](#)
Specifies the rate by which the dynamic Tset must change in function of external temperature. Together with parameter [\(ST04\) DYNAMIC TSET: MAXIMUM OFFSET FOR HEATING](#) it controls the slope of the dynamic Tset function.



The function is disabled if a probe error occurs.

7 FANS REGULATOR

According to the type of installed fans ((FP04) FANS: FANS TYPE), fans can be controlled in three different ways:

- Digital (stepping ON/OFF regulation)
- Continuous (proportional regulation)
- Maxpower (ON/OFF regulation at maximum power at any time)

digital

If Energy XT permits the use of Digital control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE

continuous

If Energy XT permits the use of Continuous control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE

maxpower

If Energy XT permits the use of Maxpower control, the following *class F* parameter is enabled:

- (FF01) FANS: CONTROL TYPE



The available modes can be selected through the *class C* parameter:

- (FF01) FANS: CONTROL TYPE

This parameter also depends on the actual configuration of fans outputs ruled by the (FP04) FANS: FANS TYPE parameter

7.1 Fans: regulation probes

Fans can be controlled by using temperature or pressure probes; they can be selected through the *class C* parameter:

- (FF02) FANS: CONTROL SENSOR (T/P)

Regulation in temperature mode

Control in Temperature mode

- (FF02) FANS: CONTROL SENSOR (T/P) = temperature_sensor (analogue input)
- Or
- (FF02) FANS: CONTROL SENSOR (T/P) = temperature_di (digital input)

To be able to control temperature on chillers, it is necessary to set a dedicated temperature probe on the condenser. This can be:

- Analogue sensor ((FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE = true)
- Analogue sensor ((FP07) FANS: TEMPERATURE DIGITAL INPUT DEDICATED FOR FANS PRESENCE = true)

On heat pumps and reversible units, the temperature used for control purposes is calculated using the average of the defrost probes ((DF12) DEFROST: CONDENSER DF ADDITIONAL TEMP SENSORS ENABLE for analogue probes and (DF13) DEFROST: CONDENSER DF ADDITIONAL PRESS SENSORS ENABLE for digital probes).

Regulation in pressure mode



Control in Pressure mode

- (FF02) FANS: CONTROL SENSOR (T/P) = pressure_sensor (analogue input)
- Or
- (FF02) FANS: CONTROL SENSOR (T/P) = pressure_of (digital input)

In any case the pressure probe on the capacitor is used.

The parameters configuration described above must clearly be consistent (for example, if (FF02) FANS: CONTROL SENSOR (T/P) is selected in Temperature mode and the device is a chiller, then a temperature probe is required on the condenser ((FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE = true or (FP07) FANS: TEMPERATURE DIGITAL INPUT DEDICATED FOR FANS PRESENCE = true).

It is useful to note that if CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE (fixed maximum and minimum pressure probes) and (FF02) FANS: CONTROL SENSOR (T/P)=condenser_pressure_sensor, the regulation probe is the maximum circuit pressure probe of the chiller or the minimum pressure probe of the pump.

7.2 Fans: activation

Fans can be enabled:

- regardless compressors status
- if at least a circuit compressor is on

This selection is performed by properly setting the *class C* parameter:

- (FF03) FANS: OFF IF COMPRESSORS OFF

It is possible to determine how long the fan shall operate at its maximum power at device start-up; this time can be separately set for chiller devices and heat pump through the *class C* parameters:

- (FM17) FANS: PICKUP TIME COOLING
- (FM20) FANS: PICKUP TIME HEATING.

7.3 Step fan control (digital)

The step control of fans is used when each capacitor is provided with several fans (but it can be also enabled on capacitor with one fan only).

The number of steps is set through the (FP01) FANS: NUMBER OF FANS PER CIRCUIT parameter (each step relates to a fan).

Steps activation

Steps activation
The n step is enabled when the regulation temperature (or pressure) reaches the Setpoint set by the *class C* parameter:

- (FR02) FANS STEP *COOLING*: TEMPERATURE *SET POINT* STEP 2 ... (FR16) FANS STEP *COOLING*: TEMPERATURE *SET POINT* STEP 8 (or (FR01) FANS STEP *COOLING*: PRESSURE *SET POINT* STEP 2 ... (FR15) FANS STEP *COOLING*: PRESSURE *SET POINT* STEP 8)

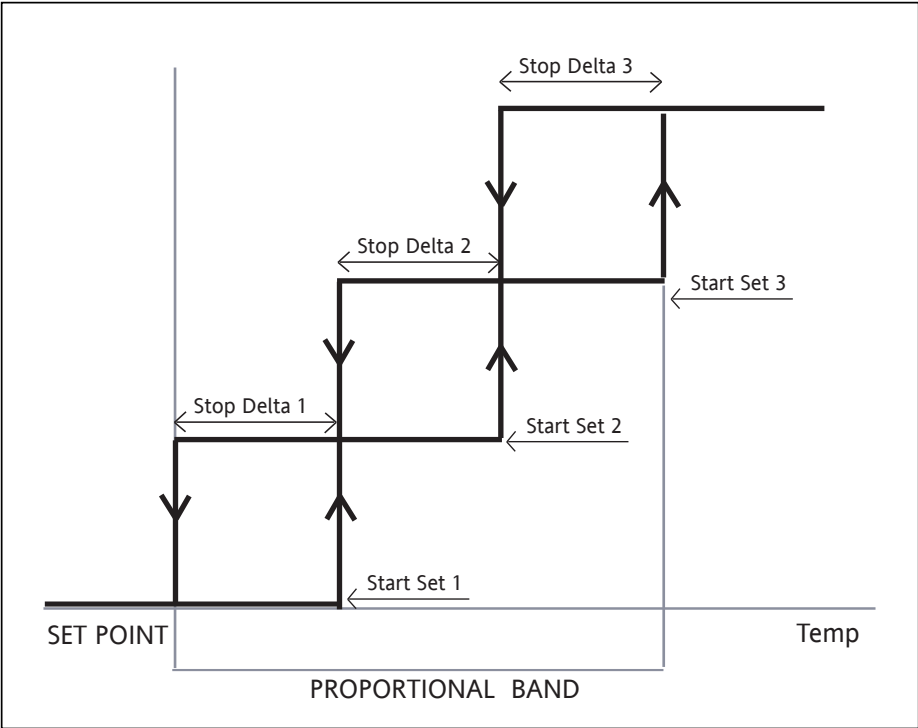
Steps deactivation

Steps deactivation:
the n step is removed when the regulation temperature (or pressure) reaches the value set by the *class C* parameters:

- ((FR01) FANS STEP *COOLING*: PRESSURE *SET POINT* STEP 2 ... (FR15) FANS STEP *COOLING*: PRESSURE *SET POINT* STEP 8)-((FR17) FANS STEP *COOLING*: TEMP HYSTERIS STEP 1 ... (FR24) FANS STEP *COOLING*: TEMP HYSTERIS STEP 8)
[or ((FR01) FANS STEP *COOLING*: PRESSURE *SET POINT* STEP 2)- ((FR24) FANS STEP *COOLING*: TEMP HYSTERIS STEP 8 ... (FR32) FANS STEP *COOLING*: PRESSURE HYSTERIS STEP 8)]

7.3.1 Stepping fan control: cooling

If the regulation is performed through a probe in temperature mode the following diagram is valid:



Temp: temperature	Start Set n: start of fan n
<i>SET POINT</i> : <i>set point</i>	Stop Delta n: stop delta of fan n

Given an i index fan, the following parameters are valid:

- (FH02) FANS STEP *HEATING*: TEMPERATURE *SET POINT* STEP 1 ... (FH16) FANS STEP *HEATING*: TEMPERATURE *SET POINT* STEP 8
Class C parameter which determines the starting temperature of the i fan.
- (FH17) FANS STEP *HEATING*: TEMP HYSTERIS STEP 1 ... (FH24) FANS STEP *HEATING*: TEMP HYSTERIS STEP 8
Class C parameter which determines the temperature difference (compared with SETC1) at which the i fan stops.

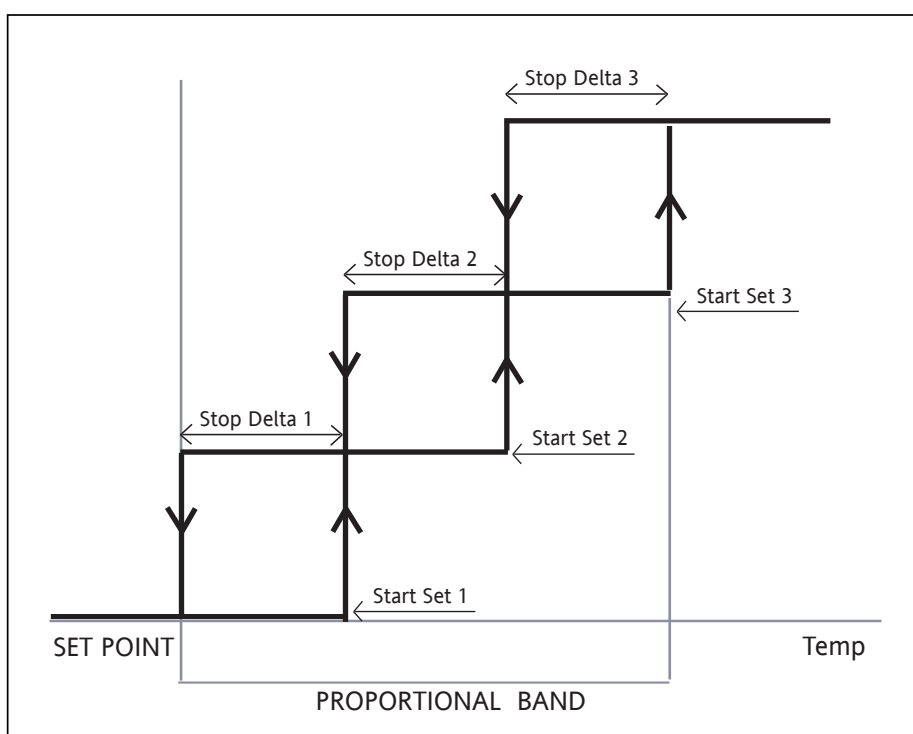
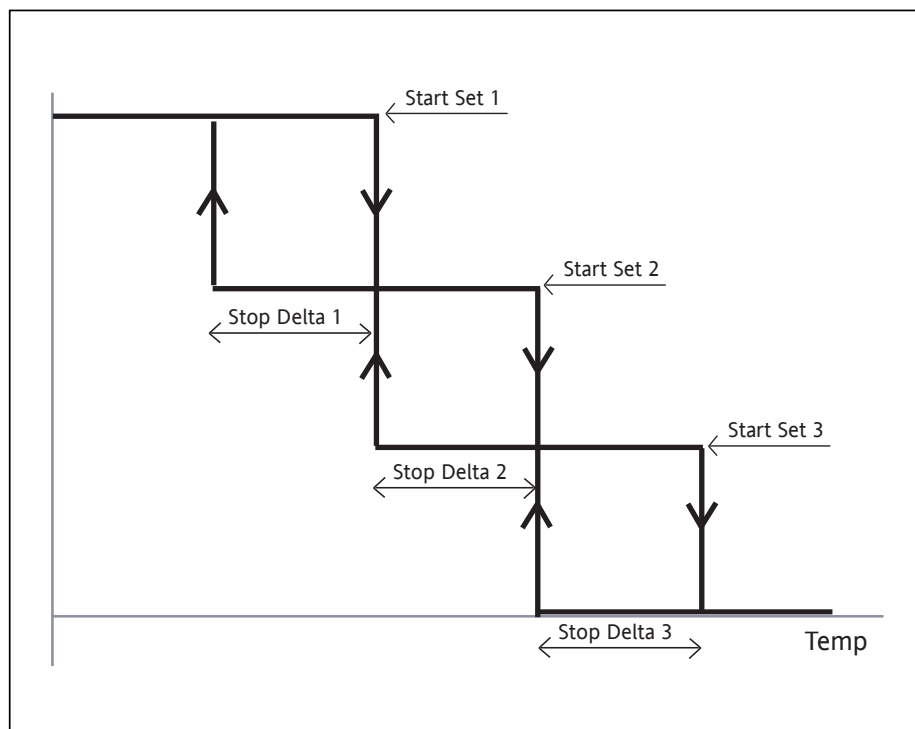
When using a probe in pressure mode, the diagram is similar to the previous one: on the horizontal axis Set-point and Delta are in BAR.

In this case, given an i index fan, the following parameters are valid:

- (FH01) FANS STEP *HEATING*: PRESSURE *SET POINT* STEP 1 ... (FH15) FANS STEP *HEATING*: PRESSURE *SET POINT* STEP 8
Class C parameter which determines the starting pressure of the i fan.
- (FH25) FANS STEP *HEATING*: PRESSURE HYSTERIS STEP 1 ... (FH32) FANS STEP *HEATING*: PRESSURE HYSTERIS STEP 8
Class C parameter which determines the pressure difference (compared with SETC1) at which the i fan stops.

7.3.2 Stepping fan control: heating

If the regulation is performed through a probe in temperature mode the following diagram is valid:



Temp: temperature	Start Set n: start of fan n
SET POINT: set point	Stop Delta n: stop delta of fan n

Given an *i* index fan, the following parameters are valid:

- (FH02) FANS STEP **HEATING**: TEMPERATURE **SET POINT** STEP 1 ... (FH16) FANS STEP **HEATING**: TEMPERATURE **SET POINT** STEP 8
Class C parameter which determines the starting temperature of the *i* fan.
- (FH17) FANS STEP **HEATING**: TEMP HYSTERIS STEP 1 ... (FH24) FANS STEP **HEATING**: TEMP HYSTERIS STEP 8
Class C parameter which determines the temperature difference (compared with SETC1) at which the *i* fan stops.

When using a probe in pressure mode, the diagram is similar to the previous one: on the horizontal axis Set-point and Delta are in BAR.

In this case, given an *i* index fan, the following parameters are valid:

- (FH01) FANS STEP *HEATING*: PRESSURE *SET POINT* STEP 1 ... (FH15) FANS STEP *HEATING*: PRESSURE *SET POINT* STEP 8
Class C parameter which determines the starting pressure of the *i* fan.
- (FH25) FANS STEP *HEATING*: PRESSURE *HYSTERIS* STEP 1 ... (FH32) FANS STEP *HEATING*: PRESSURE *HYSTERIS* STEP 8
Class C parameter which determines the pressure difference (compared with SETC1) at which the *i* fan stops.

7.3.3 Control with fan of equal/different power

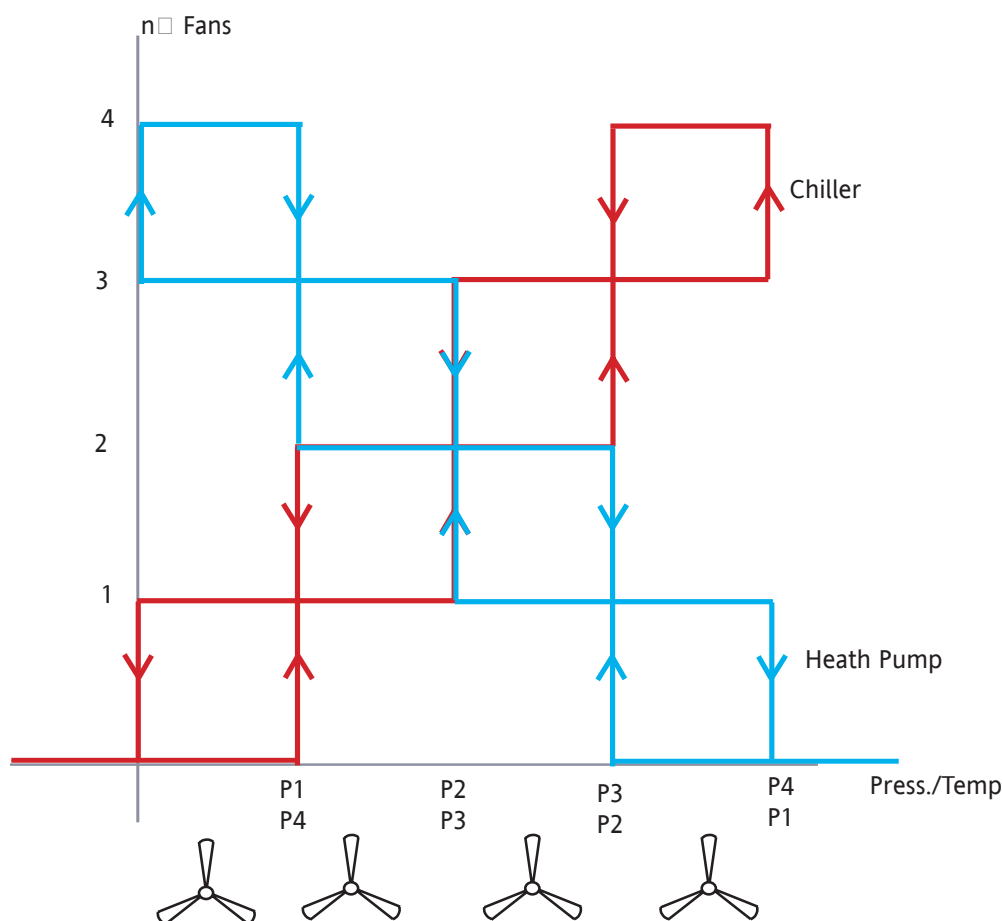
Equal power

If the fans of the same capacitor are all equal, they are enabled in a continuous mode (if three steps are required, three fans are active).

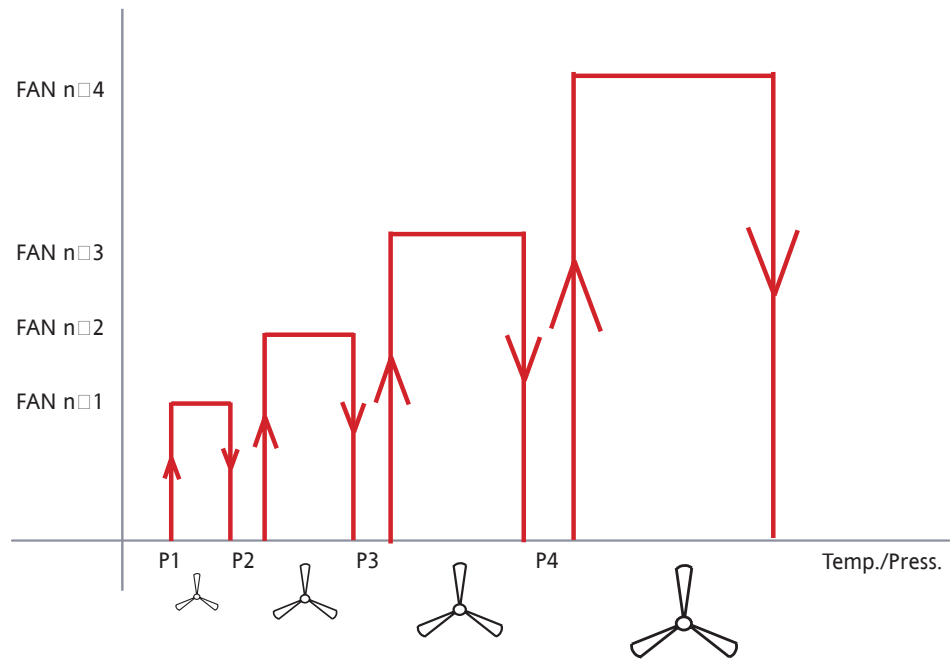
Different power

If the fans power is different (this option can be set through the FANS_ASIMMETRICAL_FLAG parameter), fans are alternatively enabled (enabling fan 3, fan 2 is disabled).

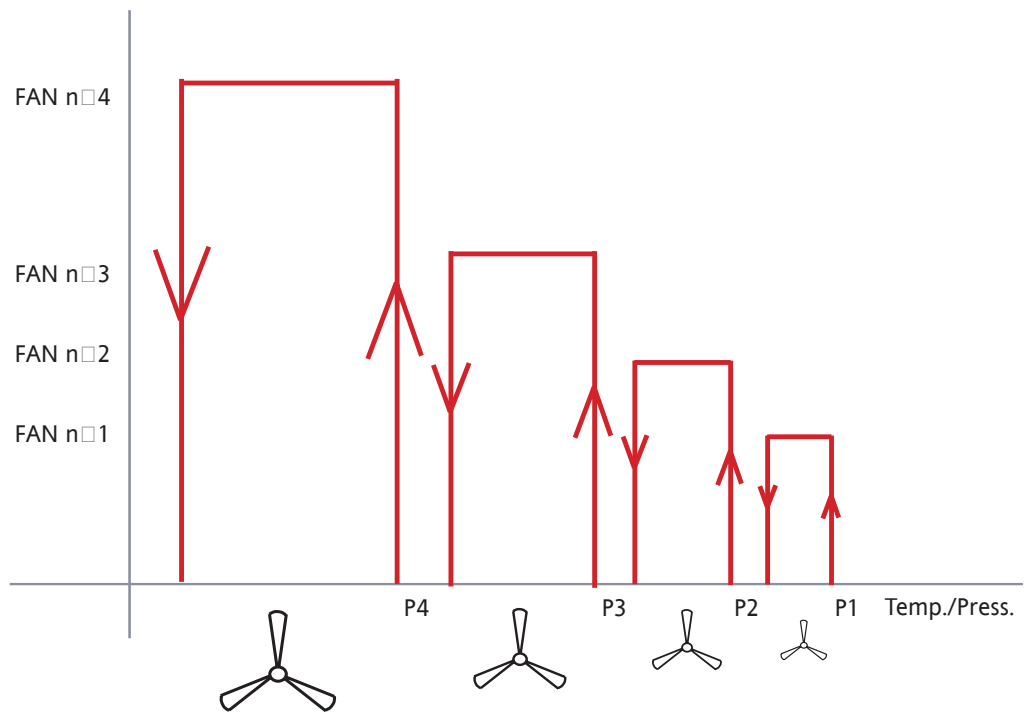
The following picture explains the principle of regulation:



Press./Temp: pressure/temperature	N° Fans : number of running fans
-----------------------------------	----------------------------------



FAN ° n : number of fan n	Temp./Press: temperature/pressure
---------------------------	-----------------------------------



FAN ° n : number of fan n	Temp./Press: temperature/pressure
---------------------------	-----------------------------------

7.4 Fans control in continuous mode (continuous)

The regulator directly manages the fans between a minimum and a maximum output value; These values can be set in *cooling* mode (*heating*) through the *class C* parameters: rotation speed

(FM18) FANS: MIN SPEED COOLING ((FM21) FANS: MIN SPEED HEATING)

Minimum rotation speed of fans after start-up.

(FM19) FANS: MAX SPEED COOLING ((FM22) FANS: MAX SPEED HEATING)

Maximum rotation speed of the fans after start-up.

These parameters are only valid for fans with continuous control.
The output value is meant as a percentage of the mains voltage.

The following parameters are valid:

Pick-up

(FM17) FANS: *PICKUP TIME COOLING*

(FM20) FANS: *PICKUP TIME HEATING*.

Class C parameters which determine how long fans operate at their maximum power after start-up (*cooling* and *heating*).

Cut off

It determines the temperature/pressure value at which fans shall be switched off.

the related parameters are then listed in the *cooling (heating)* case:

(FM25) FANS: *CUT-OFF ENABLE COOLING* ((FM26) FANS: *CUT-OFF ENABLE HEATING*)

Class C parameter which enables the Cut Off

(FM03) FANS: *CUT-OFF PRESSURE SET POINT* ((FM06) FANS: *CUT-OFF PRESSURE SET POINT*)

Class C parameter which determines the *Set Point* of the Cut Off.

The pressure below which the Cut Off starts and the fans switch off is set.

In case of probe in temperature mode, the following *class C* parameter is valid:

(FM01) FANS: *CUT-OFF TEMPERATURE SET POINT* ((FM04) FANS: *CUT-OFF:TEMPERATURE SET POINT*)

(FM23) FANS: *CUT-OFF PRESSURE HYSTERESIS COOLING* ((FM24) FANS: *CUT-OFF PRESSURE HYSTERESIS HEATING*)

Class C parameter which determines the Cut Off difference: it indicates the fans start-up pressure when the Cut off is enabled.

In case of probe in temperature mode, the following *class C* parameter is valid:

(FM02) FANS: *CUT-OFF TEMPERATURE HYSTERESIS* ((FM05) FANS: *CUT-OFF TEMPERATURE HYSTERESIS*)

Cut-Off by-pass

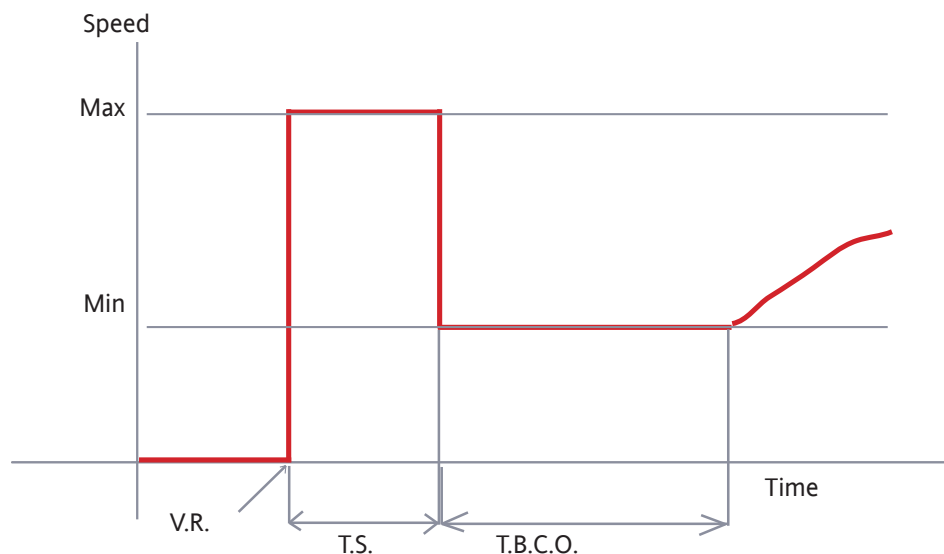
After the pick-up for a time set through a parameter, the *cut-off* is interrupted and fans operate at their minimum speed; when this time is over, fans work according to the regulation temperature/pressure. the related parameters are then listed in the *cooling (heating)* case:

(FM15) FANS: *CUT-OFF BYPASS TIME HEATING* ((FM16) FANS: *CUT-OFF BYPASS TIME COOLING*)

Class C parameter which determines the Cut Off by-pass time in conditioning mode.

It determines the time interval when the Cut Off is bypassed, i.e. if this parameter is enabled, the fans regulation does not consider the Cut Off from zero up to the parameter time value.

The following diagram shows the pick-up and *cut-off by-pass* effect on the fans speed when a fans start-up request occurs.



V.R. = Fans regulation	T.S. = Pick-up time
T.B.C.O. = cut-off bypass time	Speed: speed
Time: Time	

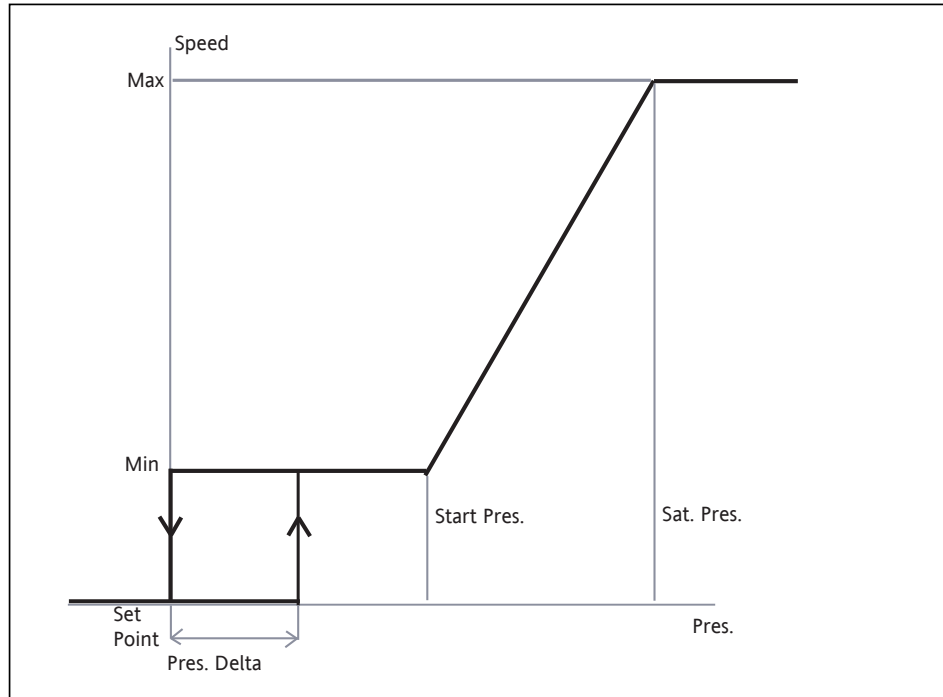
The cut off bypass prevents undesired oscillations.

7.4.1 Continuous fans control: cooling

Besides the *cut-off* parameters (see above), the following parameters are enabled:

- (FM09) FANS: PRESS [SET POINT](#) FOR MIN FAN SPEED [COOLING](#)
[Class C](#) parameter which determines the pressure at which fans begins to be linearly modulated.
In case of probe in temperature mode, the following [class C](#) parameter is valid:
(FM07) FANS: TEMP [SET POINT](#) FOR MIN FAN SPEED [COOLING](#)
- (FM10) FANS: PRESS [SET POINT](#) FOR MAX FAN SPEED [COOLING](#)
[Class C](#) parameter which determines the pressure at which fans [saturation](#) occurs.
In case of probe in temperature mode, the following [class C](#) parameter is valid:
(FM08) FANS: TEMP [SET POINT](#) FOR MAX FAN SPEED [COOLING](#)

The interaction of parameters is summarized in the following diagram:

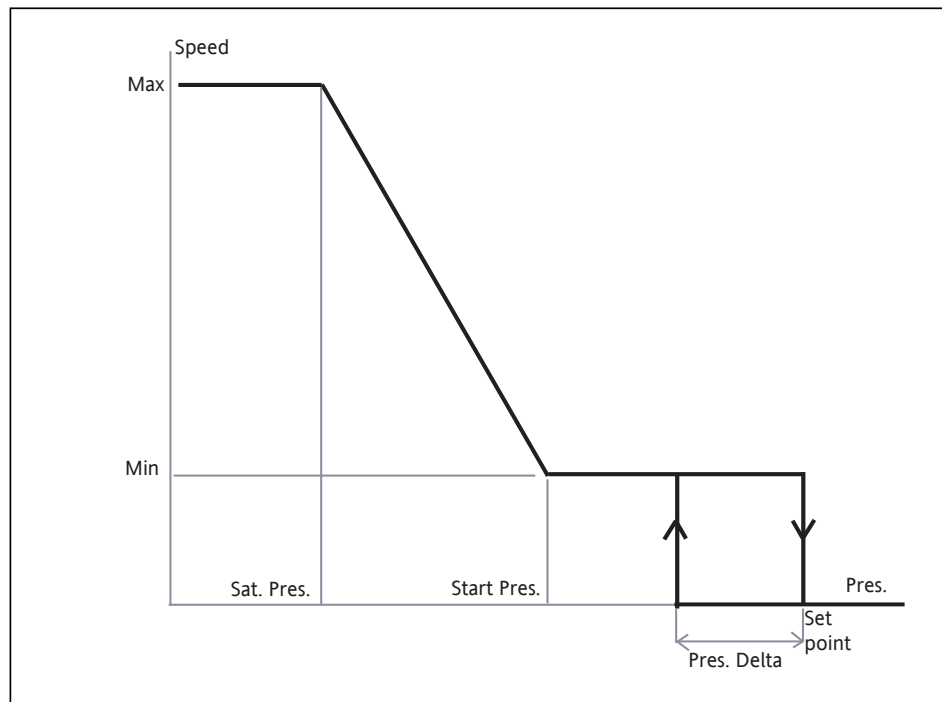


Pres. : pressure	Sat. Pres : pressure at maximum speed
Start Pres.: pressure at which the fan speed starts to increase	Delta Pres.: delta at which the fans are started at minimum speed
Speed: speed	

The cut off bypass prevents undesired oscillations. Besides the [cut-off](#) parameters (see above), the following parameters are enabled:

- (FM13) FANS: PRESS [SET POINT](#) FOR MIN FAN SPEED [HEATING](#)
[Class C](#) parameter which determines the pressure at which fans begins to be linearly modulated.
In case of probe in temperature mode, the following [class C](#) parameter is valid:
(FM11) FANS: TEMP [SET POINT](#) FOR MIN FAN SPEED [HEATING](#)
- (FM14) FANS: PRESS [SET POINT](#) FOR MAX FAN SPEED [HEATING](#)
[Class C](#) parameter which determines the pressure at which fans [saturation](#) occurs.
In case of probe in temperature mode, the following [class C](#) parameter is valid:
(FM12) FANS: TEMP [SET POINT](#) FOR MAX FAN SPEED [HEATING](#)

The interaction of parameters is summarised in the following diagram:



Pres.: pressure	Sat. Pres: pressure at which the fan speed starts to decrease
Start Pres.: pressure at which the fans start running at minimum speed	Delta Pres.: delta at which the fans are started at minimum speed
Speed: speed	

7.5 Maxpower fans control (on/off)

The fans can be run in On/Off mode by setting the following [Class C](#) parameter:
[\(FF01\) FANS: CONTROL TYPE](#)

In this case fans are only provided with two possible speed levels: 0% and 100%.
 Also in this case pick-up time, [cut-off](#) and [cut-off by-pass](#) time are valid.

8 FUNCTIONS

8.1 Recording the hours of operation

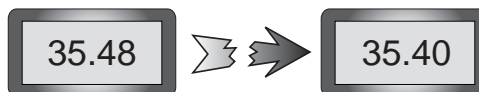
The device stores the number of operating hours for the following in the *non volatile memory*:

- Hydraulic pump
- *Compressors*

Internal resolution is in minutes.

Values can be displayed and *reset* by means of the related menus. The availability, name and layout of the menus vary according to how the user has organized the tree view with tool MenuMaker.

In the event of power failure, the last fraction of registered minutes is set to 0; thus the duration is rounded by defect.



8.2 Defrost

The *defrost* function, active in *HEATING* mode only, is used to prevent the formation of ice on the evaporator surface. The formation of ice on the evaporator (which is referred to as *condensation block* in the description because the components listed refer to the chiller), which frequently occurs with low external temperatures, significantly reduces the thermal yield of the unit, sometimes causing severe damage. *Defrost* is carried out independently on each group of evaporators of the unit.

For further information on the configuration of probes, see subchapter Configuration of probes.

8.3 Available defrost functions

Energy XT offers several types of *defrost functions*:

Available on reversible units only.

This mode can be used only if the unit is equipped with *reversing valves* in each circuit.

After the reversing of the cycle, the system can enable one of the following 4 *defrost* modes, which differ by the procedure used to enable the safety timers of the *compressors*. These are:

- Soft Inversion
- Fast Inversion
- Fast Inversion wpd
- Energy 400

The mode can be selected with parameter *(DF19) DEFROST: TYPE*, which can acquire the following values:

- DF_SOFT_INVERSION
Energy XT support a *defrost* with "Soft inversion" **cycle reversing**.
- DF_FAST_INVERSION
Energy XT supports a *defrost* with "Fast inversion" **cycle reversing**.
If the following *Class F* parameter is active:
- DF_FAST_INVERSION_WPD
Energy XT supports a *defrost* with "Fast inversion wpd" **cycle reversing**.
- DF_E400
Energy XT supports a *defrost* with "Energy 400" **cycle reversing**.
- DF_NONE
Energy XT does not support any type of *defrost* (chiller units only)

In this mode, all the electric heaters are used for the *defrost* function.

For more detailed information on the operation of this mode, see chapter Anti-freeze and *integration electric heaters*.

This mode can be selected with parameter *(DF19) DEFROST: TYPE*:

- DF_RESISTOR

The operation of the single modes is described in detail in the following chapters.

The following parameters apply to all the types of *defrost* (with electric heaters/reversing):

- *(DF20) DEFROST: START SENSOR TYPE*
Class C parameter that specifies if the *defrost* input is controlled by temperature or pressure probes.

The average value is calculated on a maximum of two sensors.

- *(DF21) DEFROST: END SENSOR TYPE*
Class C parameter that specifies if the *defrost* output is controlled by temperature or pressure probes.

The average value is calculated if several dedicated sensors (in addition to the condenser *temperature sensor*) are present (*(DF12) DEFROST: CONDENSER DF ADDITIONAL TEMP SENSORS ENABLE/(DF13) DEFROST: CONDENSER DF ADDITIONAL PRESS SENSORS ENABLE*).

If parameter *(DF22) DEFROST: CONFIGURATION* is set to:

Defrost with cycle reversal

Defrost with electric heaters

Defrost: shared parameters

Single defrost

Simultaneous defrost



- (DF22) DEFROST: CONFIGURATION = DF_SINGLE_EVAPORATOR_DEFROST
Energy XT enables each circuit to be defrosted independently.

If parameter (DF22) DEFROST: CONFIGURATION is set to:

- (DF22) DEFROST: CONFIGURATION = DF_COMMON_EVAPORATOR_DEFROST
Energy XT enables all the *circuits* of an evaporator to be simultaneously defrosted.

Available modes can be selected by means of the following *Class C* parameter:

- (DF22) DEFROST: CONFIGURATION

The enabling of the *defrost* mode on units that support *simultaneous defrost* causes all the *circuits* of the evaporator to start the *defrost* operation. Thus the *defrost* is disabled when all the *circuits* met the same *defrost* disabling conditions.

8.3.1 Defrost enabling conditions

The conditions that determine the enabling of *defrost* are described below.

When the pressure/temperature value measured by the *defrost* probe falls below the following *Class C* parameters:

- (DF18) DEFROST: START PRESS SET POINT/(DF02) DEFROST: START TEMP SET POINT (*Defrost* enabling pressure/temperature)

And the circuit is supplying at least one capacity step, the *defrost* start delay timing is started. This value can be specified with the following *Class C* parameter:

- (DF14) DEFROST: CUMULATIVE TIME BEFORE DEFROST START.

Timing interruption

Timing is interrupted if:

- The pressure/temperature value rises above that of the following *C* parameter:
 - (DF18) DEFROST: START PRESS SET POINT/(DF02) DEFROST: START TEMP SET POINT (*Defrost* enabling pressure/temperature)
- And the circuit is not supplying capacity steps.

Timing reset

Timing is *reset*:

- After a *defrost* cycle
- After a power down (power failure)
- After the *operating mode* is changed
- If the pressure/temperature value rises above that of the following *Class C* parameter:
 - (DF01) DEFROST: END PRESSURE SET POINT/(DF03) DEFROST: END TEMP SET POINT (*Defrost* disabling pressure/temperature).

If the *defrost* start delay timing elapses and the pressure/temperature measured by the probe is still below that of parameter (DF18) DEFROST: START PRESS SET POINT/(DF02) DEFROST: START TEMP SET POINT (*Defrost* start pressure/temperature) and the other *defrost* start conditions persist (i.e. the circuit is supplying at least one capacity step), the *defrost* is enabled for the maximum duration specified by the following *Class C* parameter:

- (DF16) DEFROST: MAX DURATION

A new *defrost* cycle can be enabled only after the elapse of the time specified by the following *Class C* parameter:

- (DF08) DEFROST: MIN DELAY BETWEEN TWO DEFROSTS.



If *defrost* is carried simultaneously ((DF22) DEFROST: CONFIGURATION= DF_COMMON_EVAPORATOR_DEFROST), the timing of (DF14) DEFROST: CUMULATIVE TIME BEFORE DEFROST START is not taken into account for the *circuits* that are forced to *defrost*.



In all *defrost* modes, it is always possible to start at the maximum power all the *compressors* of the other circuit that is not performing the *defrost*. This operation can be enabled with the following *Class C* parameter:

- (DF24) DEFROST: MAX POWER DURING DEFROST.

8.3.2 Control during defrost

FANS

Fans

If the pressure/temperature measured by the *defrost* probe exceeds the following *Class C* parameter (regardless of whether the *defrost* uses cycle reversing or electric heaters):

- (DF04) DEFROST: FANS AT MAX POWER PRESS SET POINT/(DF05) DEFROST: FANS AT MAX POWER TEMP SET POINT (Fan enabling in *defrost* mode)

Fans are started at maximum power.

If temperature/pressure falls below the threshold specified by the following *Class C* parameters:

- (DF04) DEFROST: FANS AT MAX POWER PRESS SET POINT-(DF06) DEFROST: FANS AT MAX POWER PRESS DIFFERENTIAL/(DF05) DEFROST: FANS AT MAX POWER TEMP SET POINT-(DF07) DEFROST: FANS AT MAX POWER TEMP DIFFERENTIAL (the fans stop).

In de-tearing mode, i.e. starting from the reversing of the valve and for time (DF09) DEFROST: DRIPPING TIME, the speed of the fans is specified by the following parameter:

- (DF25) DEFROST: FANS MAX POWER ON DRIPPIN'
 - If (DF25) DEFROST: FANS MAX POWER ON DRIPPIN'=0, the standard control in HEAT PUMP is used.
 - If (DF25) DEFROST: FANS MAX POWER ON DRIPPIN'=1, fans are forced at maximum power.

The sections below describe the operation of the single components with the available *defrost* algorithms (cycle reversing/electric heaters).

On units with a heat pump that are enabled to carry out **defrost functions**, all the fans are started at 100% of their power if the pressure (temperature) exceeds the value specified by the following **Class C** parameters:

- (DF04) **DEFROST: FANS AT MAX POWER PRESS SET POINT + (DF06) DEFROST: FANS AT MAX POWER PRESS DIFFERENTIAL**
- ((DF05) **DEFROST: FANS AT MAX POWER TEMP SET POINT+(DF07) DEFROST: FANS AT MAX POWER TEMP DIFFERENTIAL**)

And remain in this condition until the pressure (temperature) does not fall below the specified value.

- (DF04) **DEFROST: FANS AT MAX POWER PRESS SET POINT**
- ((DF05) **DEFROST: FANS AT MAX POWER TEMP SET POINT**)

All fans are on during the de-tearing mode.
The fans are off in all other modes.

COMPRESSORS

Compressors The **compressors** of the circuit that performs the **defrost** cycle are on or are started at maximum power.
When the circuit starts the **defrost**, the safety intervals of the **compressors** change according to the selected **defrost** mode.

Soft inversion The **compressors** of the circuit that performs the **defrost** operation are switched off and restarted according to the safety intervals, the interval between the capacity steps and the **pump down** procedure, if available.

Fast inversion The **compressors** of the circuit that performs the **defrost** remain on, regardless of the safety intervals, the interval between the capacity steps and the **pump down** procedure.

Fast inversion wpd The **compressors** of the circuit that performs the **defrost** are switched off and restarted, regardless of the safety intervals, the interval between the capacity steps. The start and stop **pump down** procedure is however taken into account.

Energy 400 When the circuit starts the **defrost**, the safety intervals must already be set to 0. As the **defrost** causes a release of heat in the evaporator, the controller requests the compressor of the circuit that is not performing the **defrost** to supply a higher power (in order to compensate the effects of **defrost**). This may lead the **compressors** of the other **circuits** to supply maximum power.

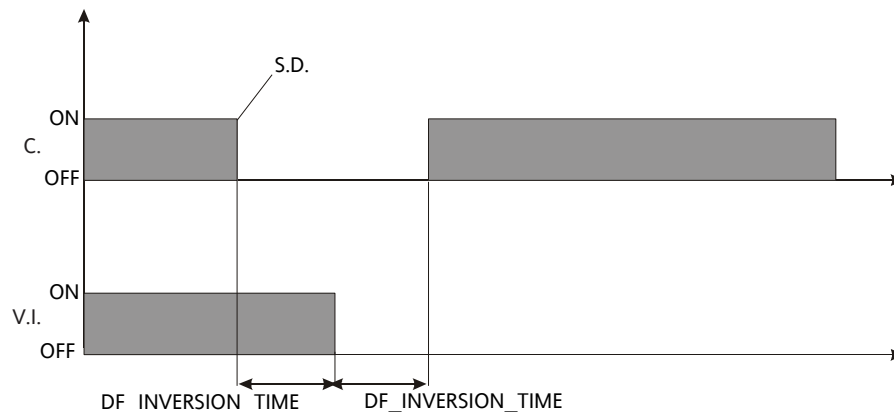
During start-up, the time specified by the following **Class C** parameter must be observed:

- (DF10) **DEFROST: OFF-ON COMPRESSOR DELAY IN DEFROST.**

If the compressor/**reversing valve** waiting time during the enabling of the **defrost** is equivalent to the time specified by the following **Class C** parameter:

- (DF11) **DEFROST: VALVE DELAY AT DEFROST START = 0**

The compressor/s active in the circuit that performs the **defrost** must stay on, otherwise the control shown in the figure below is carried out:



C.: Compressor	V.I.: Reversing valve
S.D.: Defrost start	

It is obvious that if the **defrost** is carried out independently, the **compressors** of the **circuits** that do not perform the **defrost** are enabled or maintained active by the temperature control, in accordance with standard temperature control policies.

Compensation function The **compensation function** increases to the maximum the heat request transmitted to the temperature control, regardless of whether it applies to a circuit or during the **defrost** mode. This means that the controller behaves as if the control probe acquired a value above the **set point** + delta for the whole duration of the **defrost**.
The function can be enabled with the following **Class C** parameter:

- (DF24) **DEFROST: MAX POWER DURING DEFROST.**

The pump is always on when the **compressors** are off.

Reversing valve **REVERSING VALVE**

The control of the **reversing valve** changes according to the **defrost** mode.

Soft inversion and Fast inversion wpd

The valve is enabled immediately (compatibly with the safety intervals of the **compressors**).
After the reversal of the valve, the system counts the minimum pressure bypass time, which is equivalent to the value specified by the following **Class C** parameter:

- (DF17) **DEFROST: LOW PRESS ALARM BYPASS TIME IN DEFROST.**



Fast inversion

The (DF17) **DEFROST: LOW PRESS ALARM BYPASS TIME IN DEFROST** times, the Soft Start ((SP01) **SOFT START TIME**) time and the safety intervals of the **compressors** are not taken into account.

The minimum pressure alarm bypass is controlled by parameter (AP02) **ALARMS: LOW PRESSURE ALARM BYPASS TIME** and occurs every time the **reversing valve** position (for example for each **defrost** enabling or disabling) and the number of capacity steps supplied by the circuit change. Thus, (DF17) **DEFROST: LOW PRESS ALARM BYPASS TIME IN DEFROST** applies to the **defrost** mode and is applicable only if it is above (AP02) **ALARMS: LOW PRESSURE ALARM BYPASS TIME**. The alarm is not active in the "fast" **defrost** mode.

Energy 400

The enabling of the **reversing valve** enables a "softer" control to be carried out.

When the **defrost** starts, the compressor is switched off and the system counts a delay equivalent to the following **Class C** parameter:

- (DF11) **DEFROST: VALVE DELAY AT DEFROST START**

The valve is reversed when the timing interval elapses. This enables a new delay timing, which is equivalent to (DF11) **DEFROST: VALVE DELAY AT DEFROST START**, after which the compressor restarts.

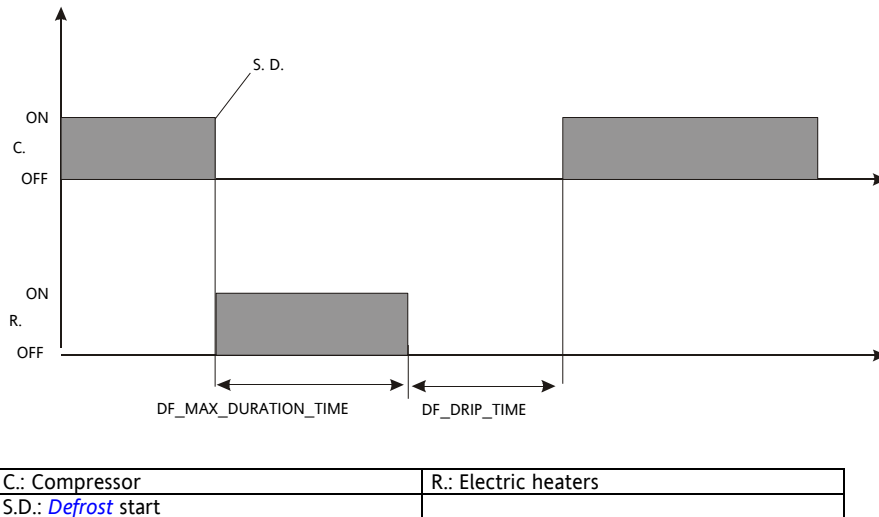
Electric heaters

ELECTRIC HEATERS

If electric heaters are used for the **defrost** ((DF19) **DEFROST: TYPE= (DF19) DEFROST: TYPE_RESISTOR**), the **compressors** of the circuit performing the **defrost** are switched off without waiting for the elapse of safety intervals.

The temperature of the **compressors** of the **circuits** not involved in the **defrost** is controlled normally.

For further information, refer to the diagram below:



8.3.3 Conditions that disable defrost

Defrost is disabled when:

- The length of the **defrost** in progress reaches the maximum time specified by the following **Class C** parameter:
 - (DF16) **DEFROST: MAX DURATION** (max. **defrost** time).
 - The **defrost** pressure/temperature exceeds the threshold specified by the following **Class** parameter:
 - ((DF01) **DEFROST: END PRESSURE SET POINT**/(DF03) **DEFROST: END TEMP SET POINT**) (**Defrost** disabling pressure/temperature).
- And the time specified by the following **Class C** parameter has elapsed:
- (DF15) **DEFROST: MIN DURATION** (Minimum **defrost** duration).

COMPRESSORS

Compressors

When the **defrost** is disabled, the safety intervals of **compressors** are changed according to the selected **defrost** mode.

Soft inversion

The **compressors** of the circuit on which the **defrost** is being disabled are switched off and restarted, if a request is received from the temperature control, taking into account the safety intervals, the intervals between the capacity steps and the **pump down** procedure, if present.

Fast inversion

The **compressors** of the circuit on which the **defrost** is being disabled stay on, if a request is received from the temperature control, regardless of the safety intervals, the interval between the capacity steps and the **pump down** procedure.

Fast inversion wpd

The **compressors** of the circuit on which the **defrost** is being disabled are switched off and restarted, if a requested from the temperature control is received, regardless of the safety intervals, the interval between the capacity steps. The **pump down** is however taken into account during the start and stop phases.

Energy 400

When the **defrost** is disabled on the circuit, the safety intervals are overridden, with the only exception of the compressor start delay (DF10) **DEFROST: OFF-ON COMPRESSOR DELAY IN DEFROST** during **defrost**. The **defrost** regulator obviously acquires the control of the **compressors** of the relevant circuit. Circuit **compressors** cannot therefore be used by the temperature controller until **defrost** has terminated on that circuit.



In the **simultaneous defrost** mode, the circuit on which the **defrost** has been disabled (and the **compressors** have been switched off) can be used by the temperature controller only when the other **circuits** have ended the **defrost**.

Reversing valve

REVERSING VALVE

In the Energy reversing mode, the enabling of *defrost* causes the *compressors* to switch off and the delay specified by the following *Class C* parameter to be counted:

- (DF11) *DEFROST: VALVE DELAY AT DEFROST START*

The valve is reversed after this interval has elapsed.

This enables the timing of the delay specified by the following *Class C* parameter:

- (DF11) *DEFROST: VALVE DELAY AT DEFROST START*

The compressor can be restarted only after this interval of time has elapsed.

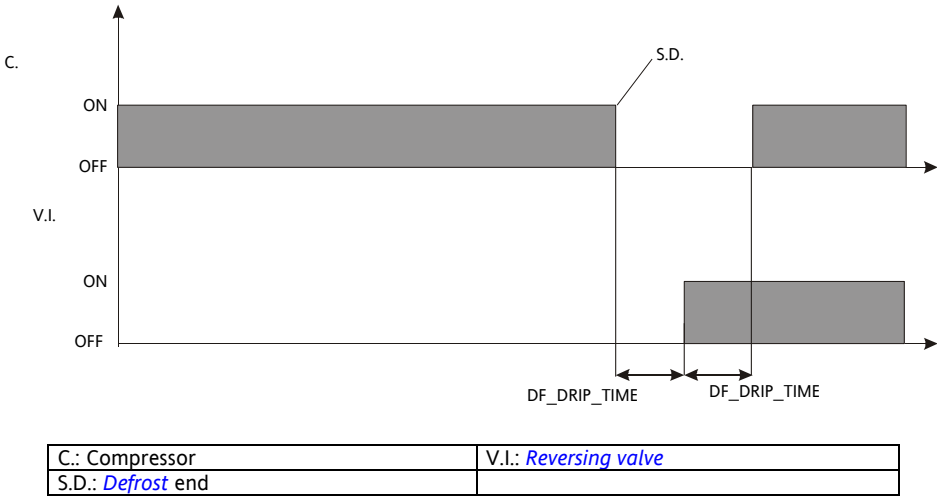
After the reversing of the valve, the system starts the minimum pressure bypass timing of the related circuit, which is equivalent to the following Class parameter:

- (DF17) *DEFROST: LOW PRESS ALARM BYPASS TIME IN DEFROST* ('Minimum pressure bypass time').

If the de-tearing time after the disabling of *defrost* in E400 mode is specified by the following *Class C* parameter:

- (DF09) *DEFROST: DRIPPING TIME*

is greater than 0, control is carried out as described in the figure below.



If (DF09) *DEFROST: DRIPPING TIME* = 0, the control is again transferred to the temperature control.

In all cases, time (DF09) *DEFROST: DRIPPING TIME* between the stop of the last compressor and the enabling of the *reversing valve* is not observed.

Electric heaters

ELECTRIC HEATERS

At the end of the *defrost*, the compressor continues to be disabled for the interval of time specified by the following *Class C* parameter:

- (DF09) *DEFROST: DRIPPING TIME*

At the end of the operation, the temperature control resumes the control of the *compressors*.

The compressor restart is controlled by temperature control, according to the safety intervals and the procedures described (*pump down* if enabled).

If (DF09) *DEFROST: DRIPPING TIME* = 0, the de-tearing operation is not performed.

8.4 Dynamic defrost set point

This function enables to change the *defrost* start *set point* automatically, depending on the external climatic conditions.

The change can be carried out in two ways:

- Using a current sensor (4-20mA), which is controlled by the setting of *Class F* parameter (SY14) *DYNAMIC TSET CURRENT SENSOR*.
- Using an external *temperature sensor*, which is controlled by *Class F* parameter (SY13) *DYNAMIC TSET EXTERNAL TEMPERATURE SENSOR*

The *operating mode* of the function can be selected with parameter:

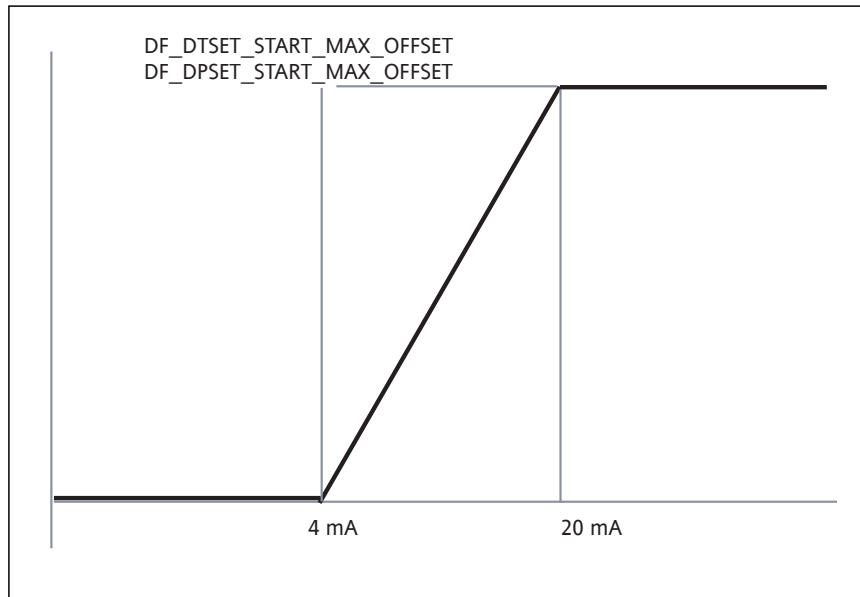
- (ST09) *DYNAMIC TSET: ENABLE*

Which can acquire the following values:

- None: the function is inactive
- Current_function: the function is active and uses the current sensor
- Temp_function: the function is active and uses the *temperature sensor*

8.4.1 Changing the set point with the current sensor

This control follows the sequence shown in the diagram below.



- If parameter:
(DF20) DEFROST: START SENSOR TYPE=DF_ENTRY_CONDENSER_PRESSURE_SENSOR
The parameter used to dynamically change the *set point* is (DF30) DEFROST: COMPENSATION PRESSURE MAXIMUM OFFSET
- If
(DF20) DEFROST: START SENSOR TYPE=DF_ENTRY_CONDENSER_TEMPERATURE_SENSOR
The parameter used is (DF29) DEFROST: COMPENSATION TEMP MAXIMUM OFFSET



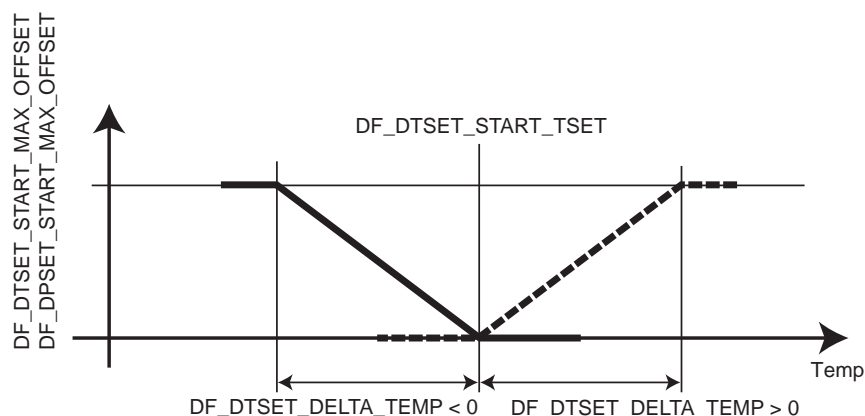
If parameters (DF30) DEFROST: COMPENSATION PRESSURE MAXIMUM OFFSET or (DF29) DEFROST: COMPENSATION TEMP MAXIMUM OFFSET are set to a negative value, the illustrated trend rotates on the horizontal axis.



The function is disabled if a probe error is active.

8.4.2 Changing the set point with a temperature sensor

This control follows the sequence shown in the diagram below.



- If parameter:
(DF20) DEFROST: START SENSOR TYPE= DF_ENTRY_CONDENSER_PRESSURE_SENSOR
The parameter used to dynamically change the *set point* is:
(DF30) DEFROST: COMPENSATION PRESSURE MAXIMUM OFFSET
- If
(DF20) DEFROST: START SENSOR TYPE= DF_ENTRY_CONDENSER_TEMPERATURE_SENSOR
The parameter used is (DF29) DEFROST: COMPENSATION TEMP MAXIMUM OFFSET



If parameters (DF30) DEFROST: COMPENSATION PRESSURE MAXIMUM OFFSET or (DF29) DEFROST: COMPENSATION TEMP MAXIMUM OFFSET are set to a negative value, the illustrated trend rotates on the horizontal axis.



8.5 Free cooling

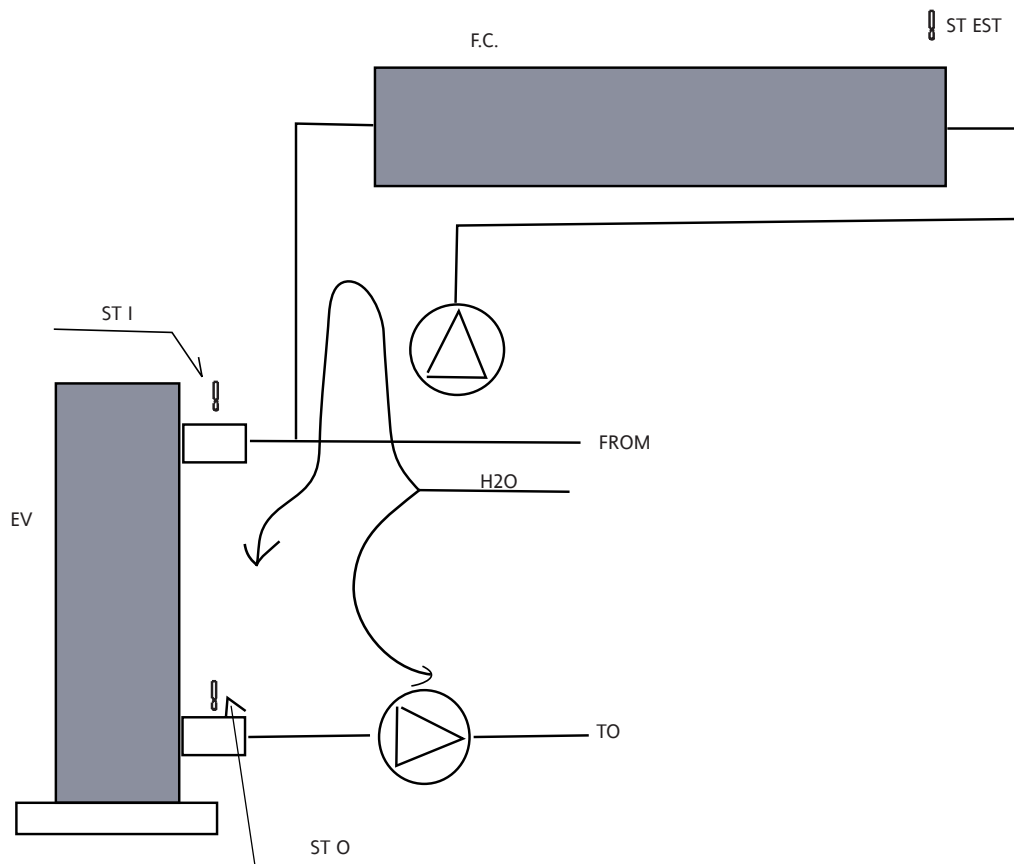
The **Free Cooling** function, which is active in **Cooling** mode only, uses the low temperature of external air to cool the water of the **cooling** circuit. The technique employed consists in circulated part of the water of the **cooling** circuit in special **free cooling** groups, located next to the fans. These exploit the low temperature of the external air to cool the circulating water, which is then re-injected into the **cooling** circuit at the input of the evaporators. This technique limits the use of **compressors** (the compressor control mode is changed during the **Free Cooling**), because these are replaced by the **Free Cooling** group.

The **Free Cooling** can be used if the following components are present:

Components

Unit	Quantity	Parameter
FREE COOLING hydraulic circuit	1	(FC08) FREECOOLING: ENABLE
FREE COOLING pump	1	FC_(SY12) PUMP GROUP ENABLE
FREE COOLING pump thermal switch	1	
Free Cooling Coil	1 x circuit	
Evaporator input temperature probe	1	
External temperature probe	1	(FC04) FREECOOLING: SENSOR

For further information, refer to the following diagram:



F.C.: Free cooling group	EV: Evaporator
ST EXT: External temperature probe	ST I: Evaporator input temperature probe
ST O: Evaporator output temperature probe	FROM: From system
TO: To system	

If Energy XT is enabled the use the components described, the **Free Cooling** function can be enabled by means of the following **Class C** parameter:

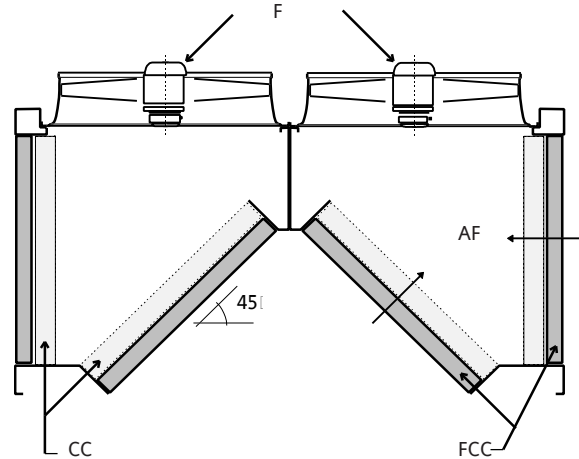
- (FC08) FREECOOLING: ENABLE

8.5.1 Free cooling: temperature control



The **Free Cooling** mode is directly influenced by the structure of the unit in which this function is used. Therefore, it is necessary to take into account also the mechanical/design characteristics of the unit in order to be able to suitably exploit the function.

Let's assume that the unit has two **circuits** with the following **Free Cooling** and condensation groups:



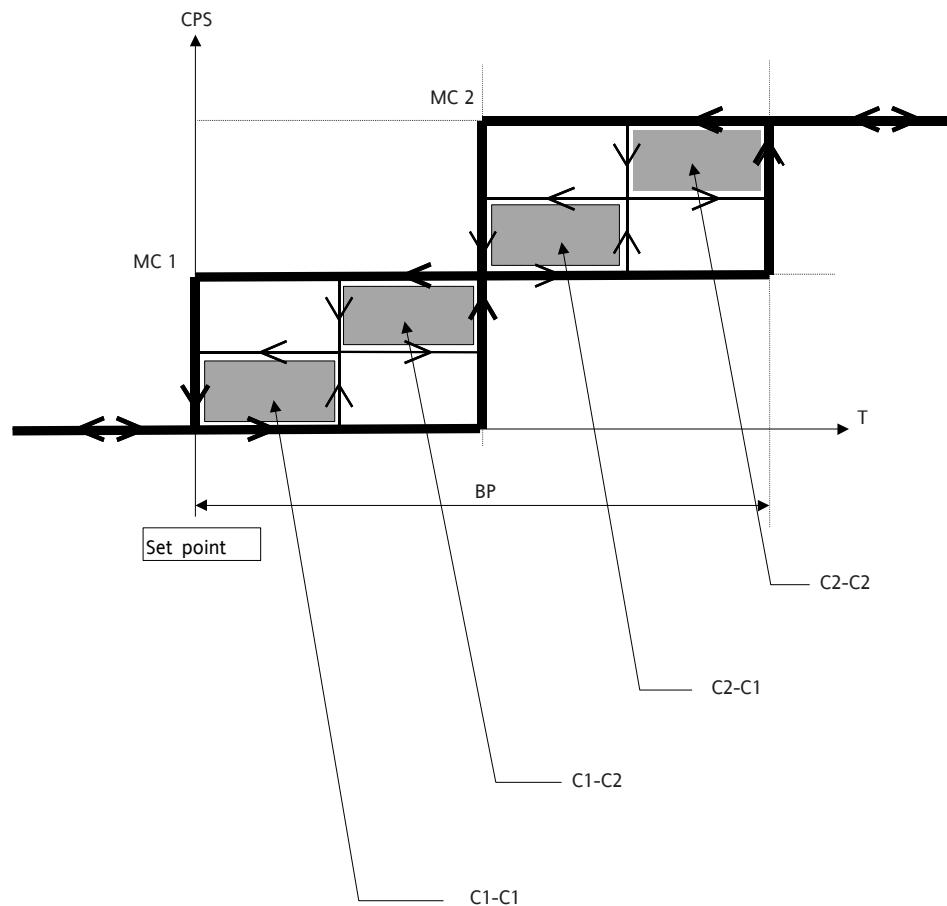
F: Fans	CC: Condensation windings
FCC: Free Cooling windings	AF: Air flow

If ventilation is forced on both **fan groups**, even the **condenser groups** may be affected by the flow of cold air. This could influence the condensation pressure of the two **cooling circuits**, if switched on. The problem lies therefore in the need of **balancing the Free Cooling** with condensation, if this is active.

This problem has been solved by adopting the following resource control policy.

All the capacity steps of the compressor of each circuit are grouped in a single macro step (see following figure).

Diagram



CPS: Cooling capacity steps	T: Temperature
MC 1: 1 st macro step	MC 2: 2 nd macro step
BP: Proportional band	C1-C1: Circuit 1 – Compressor 1
C1-C1: Circuit 1 – Compressor 2	C2-C1: Circuit 2 – Compressor 1
C2-C1: Circuit 2 – Compressor 2	

The enabling of the **Free Cooling** mode starts the "removal" of the macro steps from the constant speed **set point**.

This process is carried out by shifting the control **set point** by a delta that corresponds to a percentage value of the control band, which ranges between 30 and 75% within the interval of time specified by the following **Class C** parameter:

- **(FC05) FREECOOLING: SET POINT INC TIME**

In other words, if the **set points** shifts from:

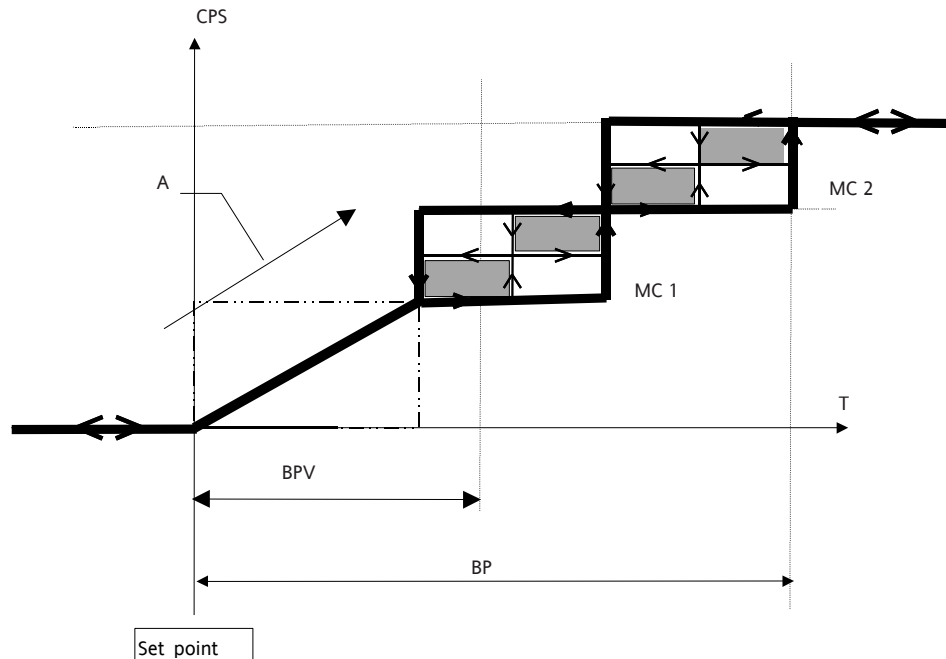
(MC01) **COOLING: SET POINT** at

(MC01) **COOLING: SET POINT** + **(FC06) FREECOOLING: PROPORTIONAL BAND*** Proportional band/100

Linearly within the interval of time specified by parameter **(FC05) FREECOOLING: SET POINT INC TIME**

The step "compression" will generally include the macro steps of the area between the proportional band and the fan proportional band.

For further information, refer to the diagram below:



CPS: Cooling capacity steps	T: Input temperature
A: Compression direction at constant speed	MC 1: 1 st macro step
MC 2: 2 nd macro step	BP: Proportional band
BPV: Fan proportional band	

8.5.2 Free cooling: enabling

The **Free Cooling** function can be enabled if the following conditions are met:

- The system is running in **Cooling** mode

The macro step compression starts even if the system is in **standby**, although the fans will be enabled only when the unit is switched on or able to do so.

- If $T_{\text{test}} < T_{\text{inp. evap}} - \text{(FC01) FREECOOLING: DIFFERENTIAL}$.
- Every evaporator can be used for the **Free Cooling**, i.e. no evaporator is in alarm mode; no **compressor swap** is present; the unit is not in alarm mode and the **compressor swap**, even with forced capacity steps, is in progress.
- The minimum interval between the enabling of two **Free Cooling** operations has elapsed (parameter **(FC03) FREECOOLING: DELAY BETWEEN 2 FREECOOLING**).
- No system, pump or **free cooling** probe is active.

8.5.3 Free cooling: disabling

The **Free Cooling** is disabled if:

- The user disables the function from the keyboard
- $T_{\text{external}} \geq T_{\text{evaporator.input}} - \text{(FC01) FREECOOLING: DIFFERENTIAL} + \text{(FC02) FREECOOLING: HYSTERESIS}$
- The "temperature control" regulator requests the enabling of at least one compressor of the circuit in which the **Free Cooling** is active.

Parameter **(FC02) FREECOOLING: HYSTERESIS** enables to define an **hysteresis** of value **(FC01) FREECOOLING: DIFFERENTIAL** that specifies the **Free Cooling** disabling condition.

The **Free Cooling** cannot be enabled together with alarms, start/stop procedures, maximum start time and maximum time with partial power.

The condensation control has priority over the **Free Cooling** and can therefore be disabled by high pressure alarms.

8.5.4 Free cooling: condensation pressure

The condensation pressure, measured by the **maximum pressure probe** (or by an external **maximum pressure pressure switch**, depending on the [system configuration](#)), must be within the limits specified by the parameters configured for a correct operation of the system.

The condensation control has priority over the [Free Cooling](#) and can therefore be disabled by high pressure alarms.

8.5.5 Free cooling: circuit control

With active
circuits

If all the [circuits](#) are active

- If the [Free Cooling](#) is enabled (i.e. if all the enabling conditions are present), the system starts measuring the time specified by the following [Class C](#) parameter:
 - [\(FC05\) FREECOOLING: SET POINT INC TIME](#)This causes the control [set point](#) to shift.
- If the [Free Cooling](#) effect is sufficient to switch the other circuit off, even its fans are forced to maximum speed for the time specified by parameter [\(FC05\) FREECOOLING: SET POINT INC TIME](#) (that starts from when the first circuit is switched off).
- If the [Free Cooling](#) action is not sufficient to maintain the stability of the macro step requests, after the time of [\(FC05\) FREECOOLING: SET POINT INC TIME](#) has elapsed, the [Free Cooling](#) is interrupted, that is:
 - The waiting time between two [Free Cooling](#) starts is loaded
 - The control of the fans is again transferred to the fan regulator
 - Macro steps are again reconverted to steps
 - The temperature control runs normally without compression (the [set point](#) resets to (MC01) [COOLING: SET POINT](#))



The intervals between subsequent starts prevent request variations that could be caused by the disabling of the [FREE COOLING](#) procedure.

With inactive
circuits

If all the [circuits](#) are inactive and the fans are started in [Free Cooling](#) mode

When time [\(FC05\) FREECOOLING: SET POINT INC TIME](#) expires:

If (MC01) [COOLING: SET POINT](#) < T_{regulation} < (MC01) [COOLING: SET POINT](#) + [\(FC06\) FREECOOLING: PROPORTIONAL BAND](#) * Proportional band / 100

The speed of the fans is modulated according to the following equation:

$$100 * [(T_{reg} - MC11) / ((FC06) \text{ FREECOOLING: PROPORTIONAL BAND} * B_{prop})]$$

T_{reg} = Control temperature

B_{prop} = Proportional band

If T_{regulation} < (MC01) [COOLING: SET POINT](#)

Fans are always off

If T_{regulation} > [\(FC06\) FREECOOLING: PROPORTIONAL BAND](#) * Proportional band / 100

Fans are always running at 100% of their power

If T_{external} ≥ T_{regulation} - [\(FC01\) FREECOOLING: DIFFERENTIAL](#) + [\(FC02\) FREECOOLING: HYSTERESIS](#)

The [Free Cooling](#) is disabled and the control is carried out normally.



The [compressor safety](#) intervals are always met.



8.6 Pump Down

The [Pump Down](#) is a special start/stop procedure used for [compressors](#).

During the stop phase, the so-called solenoid valve of the circuit upstream from the evaporator is closed before being disabled to allow the compressor to reduce the gas pressure to the [pump down](#) value while continuing to suck gas from the evaporator. The compressor switches off as soon as this low pressure value is reached.

This makes sure that the evaporator is practically empty while the compressor is switched off and avoids that the rise of temperature in the evaporator itself (caused by the exchange of heat in the evaporator) causes the rises of the low pressure to values that could not be handled by the compressor and/or evaporator.

During start-up, the [pump down](#) opens the first solenoid valve in order to increase the low pressure so that the compressor can start as soon the start pressure set by the [pump down](#) is reached.

The [Free Cooling](#) can be used if the following components are present:

Components

Unit	Quantity	Parameter
Solenoid valve	1	(PD07) PUMPDOWN: SOLENOID VALVE PRESENCE

Mode

Energy XT supports three [Pump Down](#) modes:

- Inactive function
- Function during compressor start
- Total (during the starts/stops of the compressor)

The [Pump Down](#) mode varies according to the value acquired by parameter [\(PD05\) PUMPDOWN: TYPE](#):

- [\(PD05\) PUMPDOWN: TYPE](#) = NO
Energy XT does not use the [pump down](#) mode

- (PD05) PUMPDOWN: TYPE= ON_START
Energy XT uses the *pump down* mode at start-up
- (PD05) PUMPDOWN: TYPE_FULL
Energy XT uses the *pump down* mode at start-up

The available *functions* can be set by means of the following *Class C* parameter:

- (PD05) PUMPDOWN: TYPE

8.6.1 Pump down: probes

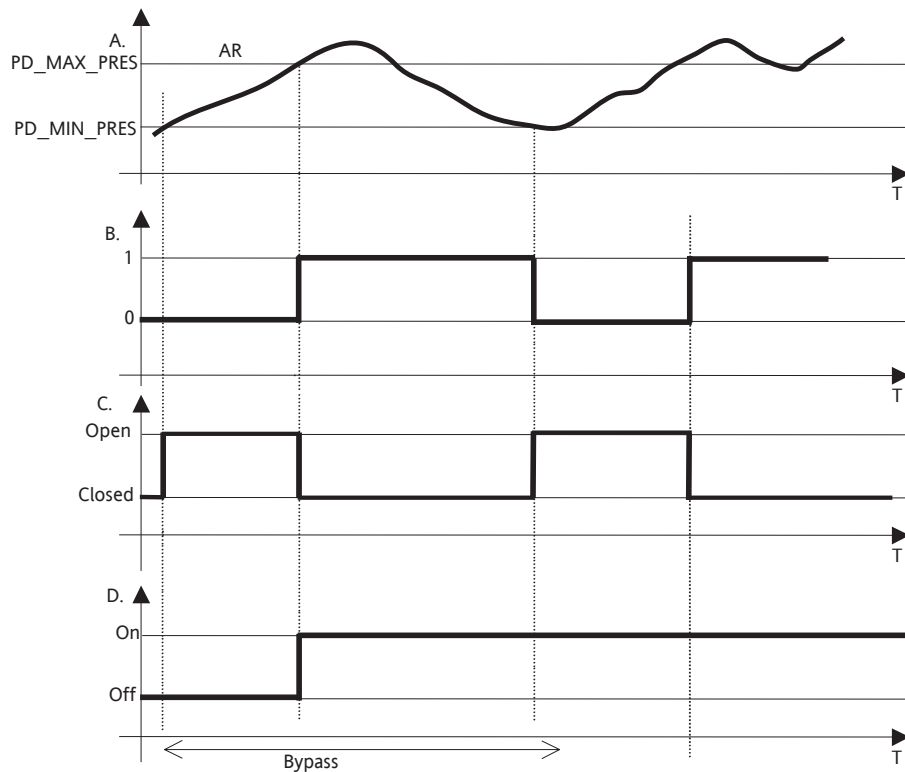
The *pump down* can be controlled with:

- Low pressure probe
- Minimum pressure digital input (minimum pressure alarm)
- Special pressure switch (see *Circuits: Pump Down* AND Configuration of probes)

8.6.2 Pump down: start

The start of a compressor in a circuit with inactive *compressors* is performed as described below (assuming that the system is configured with analogue pressure probes):

1. The solenoid valve opens. As a result, the pressure of the circuit starts to increase.
2. When the pressure exceeds the reference pressure specified by the following *Class C* parameter:
 - (PD02) PUMPDOWN: MAX PRESSURE SET POINT
 The solenoid valve closes and the compressor starts. After a minimum delay, the pressure starts to decrease.
3. When the pressure is again equivalent (falls below) the reference pressure specified by the following *Class C* parameter:
 - (PD01) PUMPDOWN: MIN PRESSURE SET POINT
 The solenoid valve reopens.



For further information, refer to the diagram below:

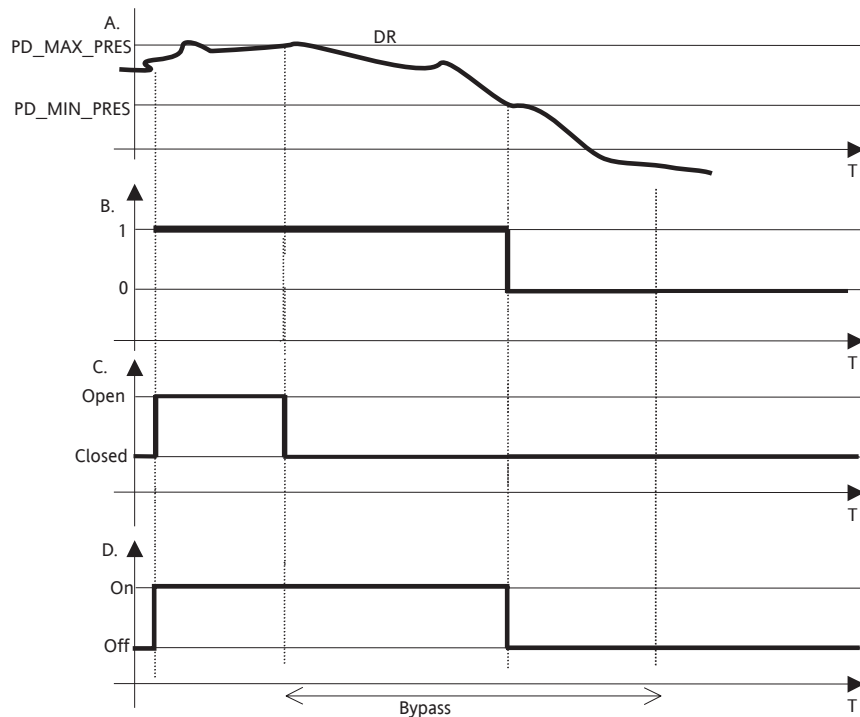
A: Minimum pressure	B: Minimum pressure pressure switch
C: Solenoid valve	D: Compressor
T: Time	AR: Start request
Open: Open valve	Closed: Closed valve

8.6.3 Pump down: stop

The powering down of the last active compressor of a circuit will be performed as described below.

1. The solenoid valve closes. The pressure starts to decrease.
2. When the pressure of the analogue probe (assuming that the system has analogue pressure probes) starts to decrease below the reference value specified by the following *Class C* parameter:
 - (PD01) PUMPDOWN: MIN PRESSURE SET POINT

The compressor switches off.



A: Minimum pressure	B: Minimum pressure pressure switch
C: Solenoid valve	D: Compressor
T: Time	AR: Start request
Open: Open valve	Closed: Closed valve

The same procedure is applied also to systems with pressure switches (instead of analogue probes). In the digital configuration, the system obviously takes into account one threshold only, which corresponds to the one that corresponds to the point in which the pressure switch value changes. In other words, **(PD01) PUMPDOWN: MIN PRESSURE SET POINT** and **(PD02) PUMPDOWN: MAX PRESSURE SET POINT** are set to the same pressure switch enabling value.

The pressure used in the **pump down** procedure is supplied by the minimum pressure probe. **(PD02) PUMPDOWN: MAX PRESSURE SET POINT** and **(PD01) PUMPDOWN: MIN PRESSURE SET POINT** are typical parameters of the minimum pressure probes.

8.6.4 Pump down: timing

The following parameters apply:

- **(PD03) PUMPDOWN: OFF-ON MAX TIME**
Class C parameter that defines the maximum duration of the **pump down** phase during the start of a circuit.

The **pump down** procedure is interrupted if it extends for more than the time specified by this variable. After the interruption, the system returns to the ordinary temperature control if the **compressors** are on or to an off status if the **compressors** are broken and/or unavailable.

- **(PD04) PUMPDOWN: ON-OFF MAX TIME**
Class C parameter that specifies the maximum duration of the **pump down** procedure during the stop of a circuit.

The **pump down** procedure is interrupted if it extends for more than the time specified by this variable. After the interruption, the system returns to the ordinary temperature control if the **compressors** are on or to an off status if the **compressors** are broken and/or unavailable.

(PD04) PUMPDOWN: ON-OFF MAX TIME can be considered as made of two parts. The first part refers to the maximum time required to reach **(PD02) PUMPDOWN: MAX PRESSURE SET POINT**, the second as the maximum time required to return to **(PD01) PUMPDOWN: MIN PRESSURE SET POINT** after the closure of the solenoid valve.

Pump Down procedures cannot be interrupted during ordinary operation, except for **defrost** and alarms.

8.6.5 Simplified pump down sequence

Premise

The **pump down** control valve is normally closed. In other words, if the coil is off, the valve is closed. The valve is also closed if the unit is not running but active.

When a compressor is started after a start request, the valve is closed (not powered) until the pressure of the circuit reaches ≤ 2 bar (PD min.).

As soon as the pressure value reaches 2 bar, the valve opens (the coil is powered) and stays open, while the compressor continues to run in accordance with the configured temperature control.

When a compressor stop request is received, the valve closes immediately while the compressor continues to run until a pressure of 2 bar is reached, after which it turns off.

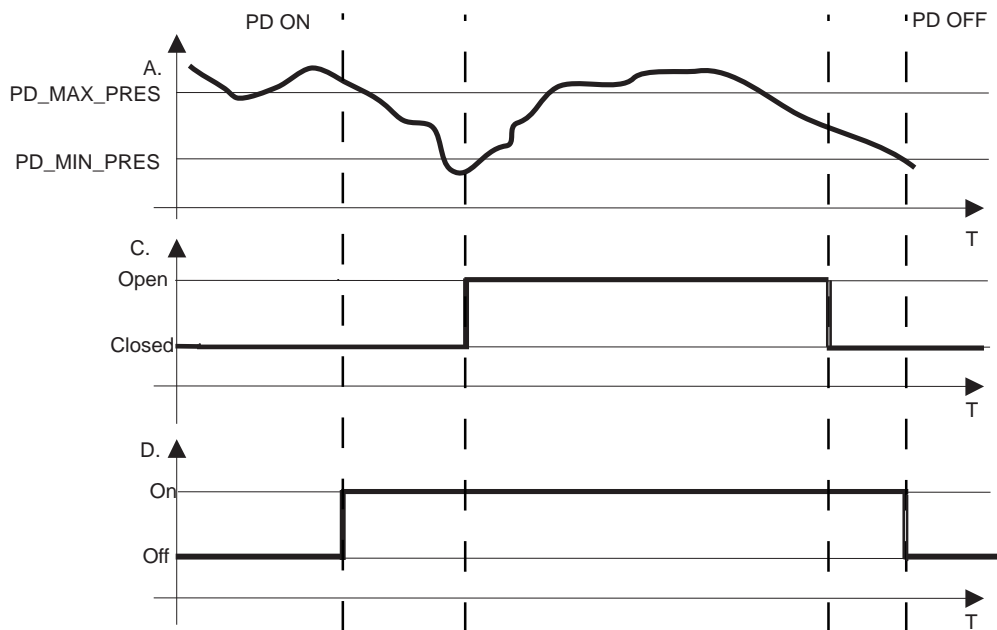
Threshold Pd Max is not used.

If the **pump down** is disabled, the valve must always be able to run in parallel and together with the compressor. Therefore:

- Compressor on = Open valve (On)
- Compressor off = Closed valve (Off).

The algorithm can be enabled by setting the following **Class C** parameter to TRUE:

- (PD09) PUMPDOWN: SOFT PUMP DOWN ALGORITHM ENABLE.



C: Solenoid valve	D: Compressor
T: Time	AR: Start request
Open: Open valve	PD ON: Pump Down enabling
Closed: Closed valve	PD OFF: Pump Down disabling



8.7 Heat recovery

The [Heat Recovery](#) function is used to exploit the heat developed by the condenser to heat, for example, water used for toilets, [heating](#) and other uses.

The [heat recovery](#) function requires the availability of the following components:

Components

Unit	Quantity	Parameter
Temperature probe – Recovery water	1	(HR11) HEAT RECOVERY: TEMPERATURE SENSOR PRESENCE
Recovery circuit flow switch	1	(HR09) HEAT RECOVERY: FLOW SWITCH PRESENCE
3-way valve	1 per circuit	(HR13) HEAT RECOVERY: THREE WAY VALVE PRESENCE
Recovery circuit pump	1 per circuit	(HR10) HEAT RECOVERY: PUMP PRESENCE

To enable Energy XT to use the [heat recovery](#) function, it is necessary to enable the following [Class C](#) parameter:

- [\(HR14\) HEAT RECOVERY: ENABLE](#)

8.7.1 Heat recovery : activation

The following conditions must apply:

- At least one circuit must be on
- The minimum condensation duration must have elapsed before the enabling of the [heat recovery](#) function. This interval of time must correspond to the value specified by the following [Class C](#) parameter:
 - [\(HR03\) HEAT RECOVERY: MINIMUM TIME](#) ;At least one compressor must be on.
- The temperature of the recovery water measured by the recovery water temperature probe ((HR11) [HEAT RECOVERY: TEMPERATURE SENSOR PRESENCE](#)) must be below the threshold specified by the following [Class C](#) parameter:
 - (HR06) [HEAT RECOVERY:TEMP SET POINT](#).
 - Recovery is enabled, in all available [circuits](#), proportionally (with recovery steps), following the same logic of the heat pump, depending on the configured [set point](#) ((HR06) [HEAT RECOVERY:TEMP SET POINT](#)) and proportional band ((HR07) [HEAT RECOVERY: PROPORTIONAL BAND](#)).

The [circuits](#) used for the [heat recovery](#) are selected at a system level using the same policy used for evaporators or at an evaporator level using the [circuits](#) that are closest to [saturation](#). The number of steps is equivalent to the number of [circuits](#). A reduction of the temperature below the [set point](#) for the increase of a recovery step is specified by [\(HR07\) HEAT RECOVERY: PROPORTIONAL BAND](#) /number of [circuits](#).

3-way valves

The pump of the circuit and the [3-way valve](#) are active during the [heat recovery](#) function. The pump circulates the heat to be heated and the valve is controlled so that water can be recirculated in the heat exchange circuit.

Fans in Cooling with heat recovery

If the unit is configured as a chiller ([Cooling](#)) with [heat recovery](#), fans are off when the [heat recovery](#) function is enabled.

8.7.2 Heat recovery : Forcing to chiller without heat recovery.

The circuit with the active [heat recovery](#) is forced to operate as chiller without [heat recovery](#) when the pressure measured by maximum pressure probe exceeds the threshold specified by the following [Class C](#) parameter:

(HR01) [HEAT RECOVERY: PRESSURE SET POINT](#)

Or when the high pressure alarm persists for the time specified by the following [Class C](#) parameter:

[\(HR04\) HEAT RECOVERY: BYPASS TIME](#)

When the system is running as chiller without [heat recovery](#), Energy XT continues to control the chiller without forcing it for an interval of time that is equivalent at least to the duration specified by the following [Class C](#) parameter:

(HR05) [HEAT RECOVERY: COOLING MIN TIME](#)

And until pressure returns to a value below that of the following [Class C](#) parameters:

(HR01) [HEAT RECOVERY: PRESSURE SET POINT](#) – (HR02) [HEAT RECOVERY: PRESSURE HYSTERESIS](#).

The [Cooling](#) mode with [heat recovery](#) can be resumed when both the following conditions apply:

When the time of (HR05) [HEAT RECOVERY: COOLING MIN TIME](#) expires

When the pressure is below (HR01) [HEAT RECOVERY: PRESSURE SET POINT](#) – (HR02) [HEAT RECOVERY: PRESSURE HYSTERESIS](#)

The same applies if the recovery disabling forcing is controlled by a special digital input, IDHR special input for [heat recovery](#) disabling ([\(HR12\) HEAT RECOVERY: PRESSURE DIGITAL INPUT PRESENCE](#)). For further information, see chapter Configuration of probes.



9 DIAGNOSTICS

This paragraph describes the alarms of the unit (providing information on the cause of the alarm, on the status of the output, on the type of [reset](#) and on the corrective action), while paragraph Errors illustrates in detail the errors of the probe.

The class of the parameter is specified in brackets.

9.1 Compressor alarms

All the alarm management procedures that switch the [compressors](#) off do not take into account safety intervals or [pump down](#) procedures.

Alarms can generally be [reset](#) (manually) from the [Alarms menu](#). Label RES indicates that the alarm can be [reset](#) manually. The availability, name and layout of this [menu](#) vary according to how the user has organised the tree view with tool MenuMaker.

9.1.1 Compressor thermal alarms

Maximum pressure in circuit 1
Maximum pressure in circuit 2
Maximum pressure in circuit 3
Maximum pressure in circuit 4
Maximum pressure in circuit 5
Maximum pressure in circuit 6
Maximum pressure in circuit 7
Maximum pressure in circuit 8

	Compressor thermal switches
Reference parameter:	(CP23) COMPRESSOR: THERMAL ALARM ENABLE (C) = 1
Input status:	Digital input of compressor thermal switches On
Output status:	Digital input of compressor thermal switches Off
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor

9.1.2 High discharge temperature alarm

Thermal switches of compressor 1
Thermal switches of compressor 2
Thermal switches of compressor 3
Thermal switches of compressor 4
Thermal switches of compressor 5
Thermal switches of compressor 6
Thermal switches of compressor 7
Thermal switches of compressor 8

	High discharge temperature
Reference parameter:	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE (C)
Input status:	$T^* > \text{(CP01) COMPRESSOR: DISCHARGE ALARM TEMP SET POINT(C)}$
Output status:	$T^* < \text{(CP01) COMPRESSOR: DISCHARGE ALARM TEMP SET POINT(C) - (CP12) COMPRESSOR: DISCHARGE TEMP DIFFERENTIAL(C)}$
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor

*The temperature represents the discharge temperature of the compressor measured by the discharge temperature probe. When using a digital input ([\(CP14\) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE](#)=DIGITALINPUT), the alarm is active if the related digital input is active.

9.1.3 Oil differential pressure alarm of compressors

Oil differential pressure of compressor 1
Oil differential pressure of compressor 2
Oil differential pressure of compressor 3
Oil differential pressure of compressor 4
Oil differential pressure of compressor 5
Oil differential pressure of compressor 6
Oil differential pressure of compressor 7
Oil differential pressure of compressor 8

If the maximum and minimum pressure probes reversal has been enabled for the chiller \leftrightarrow pump circuit, that is if:

- CIRCUIT_INV_PRES_SENSOR_FLAG=TRUE

In Chiller mode

	Oil differential pressure
Reference parameter:	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE (C)
Input status:	<ul style="list-style-type: none"> • The circuit has a low pressure probe in Chiller mode ((CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE (F)=1) and a compressor oil pressure sensor ((CP16) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE(F)) • Probe OK • Compressor ON • $P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > A_DIFFERENTIAL_PRES$ (C)
Output status:	$P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > (CP13) COMPRESSOR: OIL PRESS DIFFERENTIAL ALARM SET POINT$ (C)
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor

In Heat Pump mode

	Oil differential pressure
Reference parameter:	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE (C)
Input status:	<ul style="list-style-type: none"> • The circuit has a low pressure probe in Heating mode ((CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE (F)=1) and a compressor oil pressure sensor ((CP16) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE(F)) • Probe OK • Compressor ON • $P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > A_DIFFERENTIAL_PRES$ (C)
Output status:	$P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > (CP13) COMPRESSOR: OIL PRESS DIFFERENTIAL ALARM SET POINT$ (C)
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor

If the maximum and minimum pressure probes of the circuit are fixed:

- CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE

	Oil differential pressure
Reference parameter:	(CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE (C)
Input status:	<ul style="list-style-type: none"> • The circuit has a low pressure probe ((CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE (F)=1) and a compressor oil pressure sensor ((CP16) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE(F)) • Probe OK • Compressor ON • $P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > A_DIFFERENTIAL_PRES$ (C)
Output status:	$P_{\text{Min.press. probe.}} - P_{\text{Comp. oil press. probe}} > (CP13) COMPRESSOR: OIL PRESS DIFFERENTIAL ALARM SET POINT$ (C)
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor



The oil pressure switch is Off when the compressor is Off and bypassed every time the compressor (and not the compressor's capacity step) is switched on. Bypass parameter:

- (CP07) COMPRESSOR: OIL PRESS DIFFERENTIAL ALARM ENTRY TIME (H).

9.1.4 Oil pressure switch alarm of compressors

Oil pressure switch of compressor 1
Oil pressure switch of compressor 2
Oil pressure switch of compressor 3
Oil pressure switch of compressor 4
Oil pressure switch of compressor 5
Oil pressure switch of compressor 6
Oil pressure switch of compressor 7

Oil pressure switch of compressor 8

	Compressor oil pressure switch
Reference parameter:	(CP24) COMPRESSOR: OIL PRESSURE DIGITAL INPUT ALARM PRESENCE(C) = 1
Input status:	<ul style="list-style-type: none"> Digital input On Compressor On
Output status:	Digital input Off
Actions:	Blocks the compressor
Reset:	Manual
Applicability:	Compressor



The oil pressure switch is Off when the compressor is Off and bypassed every time the compressor (and not the compressor's capacity step) is switched on. Bypass parameter:

- [\(CP07\) COMPRESSOR: OIL PRESS DIFFERENTIAL ALARM ENTRY TIME \(H\)](#).

9.2 Valve thermal alarms

Thermal switch of fan 1
 Thermal switch of fan 2
 Thermal switch of fan 3
 Thermal switch of fan 4
 Thermal switch of fan 5
 Thermal switch of fan 6
 Thermal switch of fan 7
 Thermal switch of fan 8
 Thermal switch of fan 9
 Thermal switch of fan 10
 Thermal switch of fan 11
 Thermal switch of fan 12
 Thermal switch of fan 13
 Thermal switch of fan 14
 Thermal switch of fan 15
 Thermal switch of fan 16

	Fan thermal switch
Input status:	Digital input of fan thermal switch On
Output status:	Digital input of fan thermal switch Off
Actions:	Switches the circuit off
Reset:	Manual
Applicability:	Circuit

9.3 Minimum pressure alarm of circuits

Minimum pressure in circuit 1
 Minimum pressure in circuit 2
 Minimum pressure in circuit 3
 Minimum pressure in circuit 4
 Minimum pressure in circuit 5
 Minimum pressure in circuit 6
 Minimum pressure in circuit 7
 Minimum pressure in circuit 8

	Minimum pressure
Parameter	(AP05) ALARMS: LOW PRESSURE ALARM SET POINT (C)
Input status (*):	<p>If (PD05) PUMPDOWN: TYPE(F) =NP_PD</p> <ul style="list-style-type: none"> (CR02) COOLING LOW PRESSURE ALARM DIGITAL INPUT PRESENCE(F)=1 (minimum pressure pressure switch running) the alarm is active if the digital input of the circuit's minimum pressure pressure switch is On. (CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE =1 (presence of minimum pressure sensor in Chiller mode) or if (CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE =1 (presence of minimum pressure probe in <i>Heating</i> mode) if CIRCUIT_INV_PRES_SENSOR_FLAG=TRUE (reversing of maximum/minimum pressure probes of chiller ↔ pump circuit). (CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE =1 if CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE (fixed maximum/minimum pressure probes) <math>P_{Min, pres. probe} < \text{(AP05) ALARMS: LOW PRESSURE ALARM SET POINT}</math>. <p>If (PD05) PUMPDOWN: TYPE(F)=ON_START or FULL:</p> <ul style="list-style-type: none"> If the circuit is in alarm mode, the conditions of (PD05) PUMPDOWN: TYPE=NP_PD apply, although the alarm is masked by the enabling of the solenoid

	valve. • If the circuit is not in alarm mode, the conditions of (PD05) PUMPDOWN: TYPE=NP_PD apply; and: <ul style="list-style-type: none"> ○ The bypass time for the minimum pressure alarm, (AP02) ALARMS: LOW PRESSURE ALARM BYPASS TIME, must be elapsed. ○ At least one of the compressors of the circuit must be on. ○ The pump down procedure should not be in the on or off switching phase.
Output status:	$P_{\text{Min. pres. probe}} > \text{(AP05) ALARMS: LOW PRESSURE ALARM SET POINT} + \text{(AP06) ALARMS: LOW PRESSURE HYSTERESIS.}$
Actions:	Blocks the circuit
Reset:	If the number of alarms per hour is below (AP03) ALARMS: ALARMS EVENTS PER HOUR WITH AUTO RESET (H), reset is automatic, otherwise manual.
Applicability:	Circuit

(*) The low pressure transducer of the circuit, when parameter CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE fails to reverse when switching from Chiller to Pump mode, which means that the low pressure alarm is always generated by the same transducer.

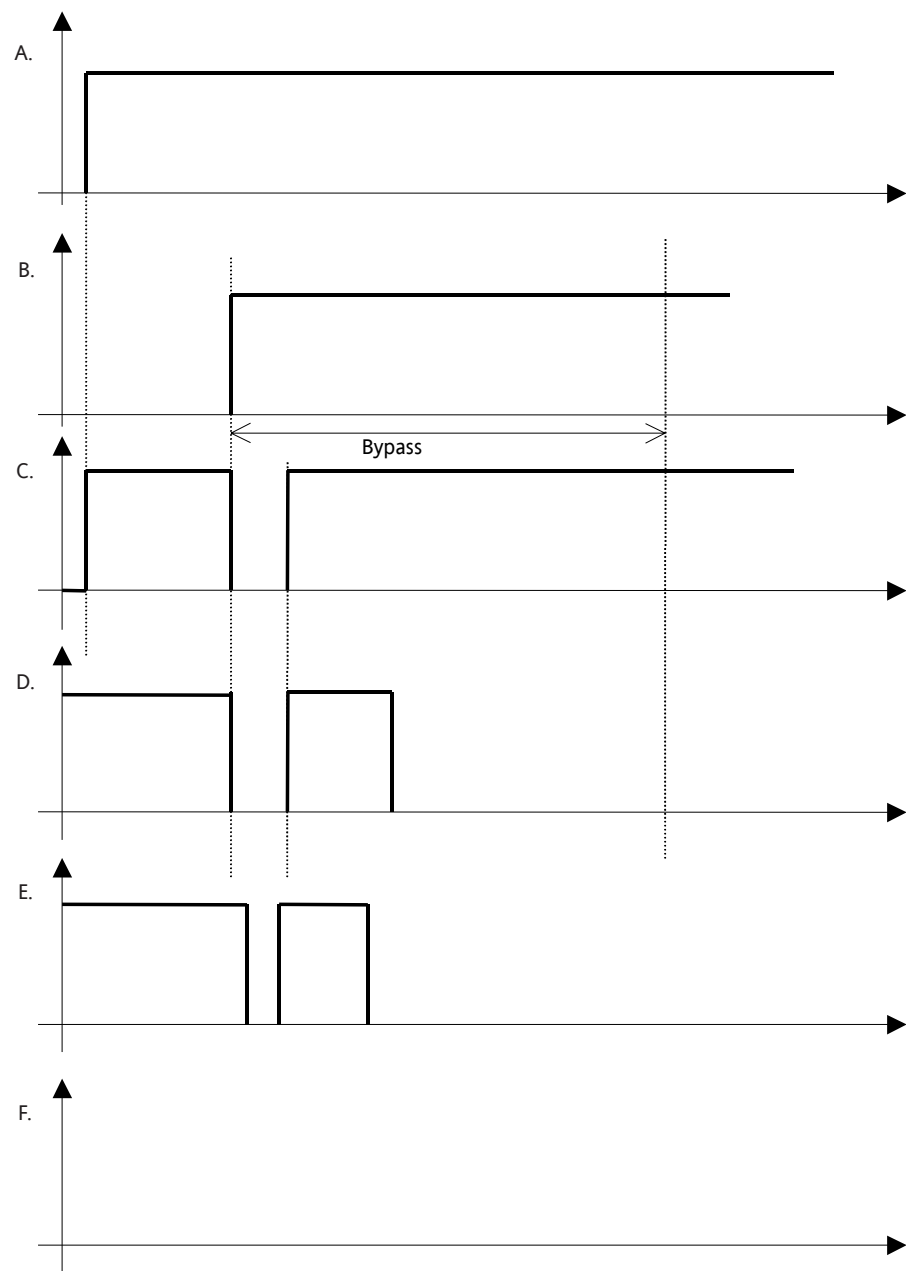


This alarm can also occur when the compressor or the unit are off.

The alarm is inactive if:

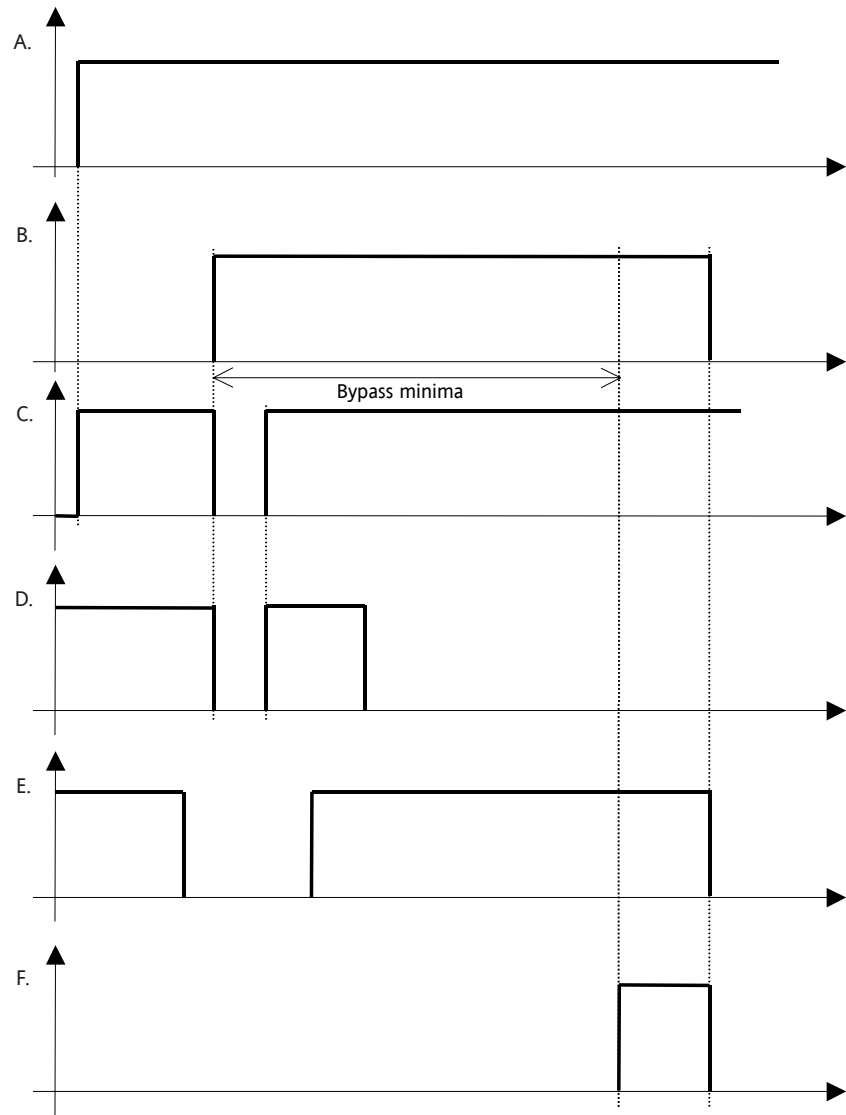
- The circuit is not in alarm mode.
- The bypass interval from the enabling of [defrost](#) (DF17) [DEFROST: LOW PRESS ALARM BYPASS TIME IN DEFROST](#) has not elapsed.
- The bypass interval of the minimum pressure alarm [\(AP02\) ALARMS: LOW PRESSURE ALARM BYPASS TIME](#) has not elapsed. This interval starts from the enabling of the [reversing valve](#) or when the power supplied by the compressor of the [circuits](#) changes.

Example of [pump down](#) during the switching on of a compressor without minimum pressure alarm:



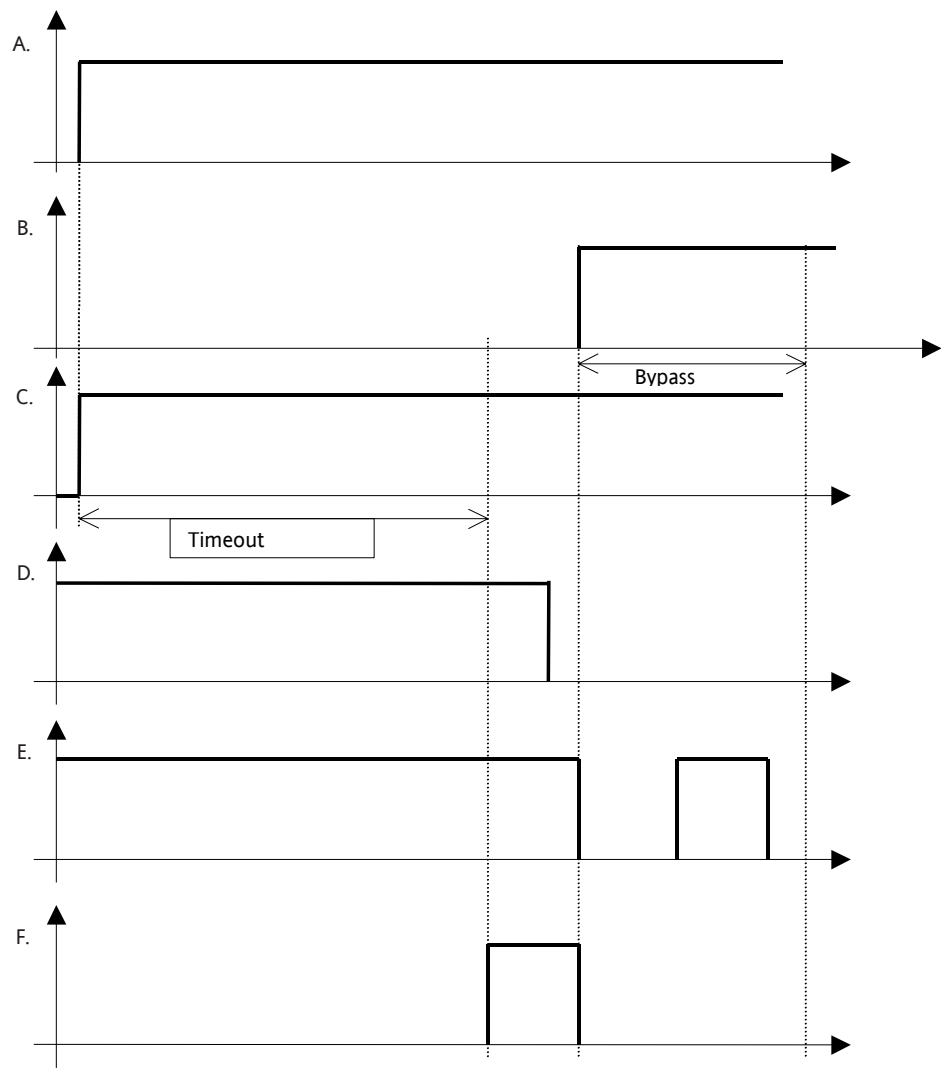
A.: Temperature control	B.: Compressor
C.: Solenoid valve (Up = Open)	D.: Pressure switch PD
E.: Minimum pressure pressure switch	F.: Automatic minimum pressure alarm

Example of minimum pressure alarm with *pump down* during the switching on of a compressor:



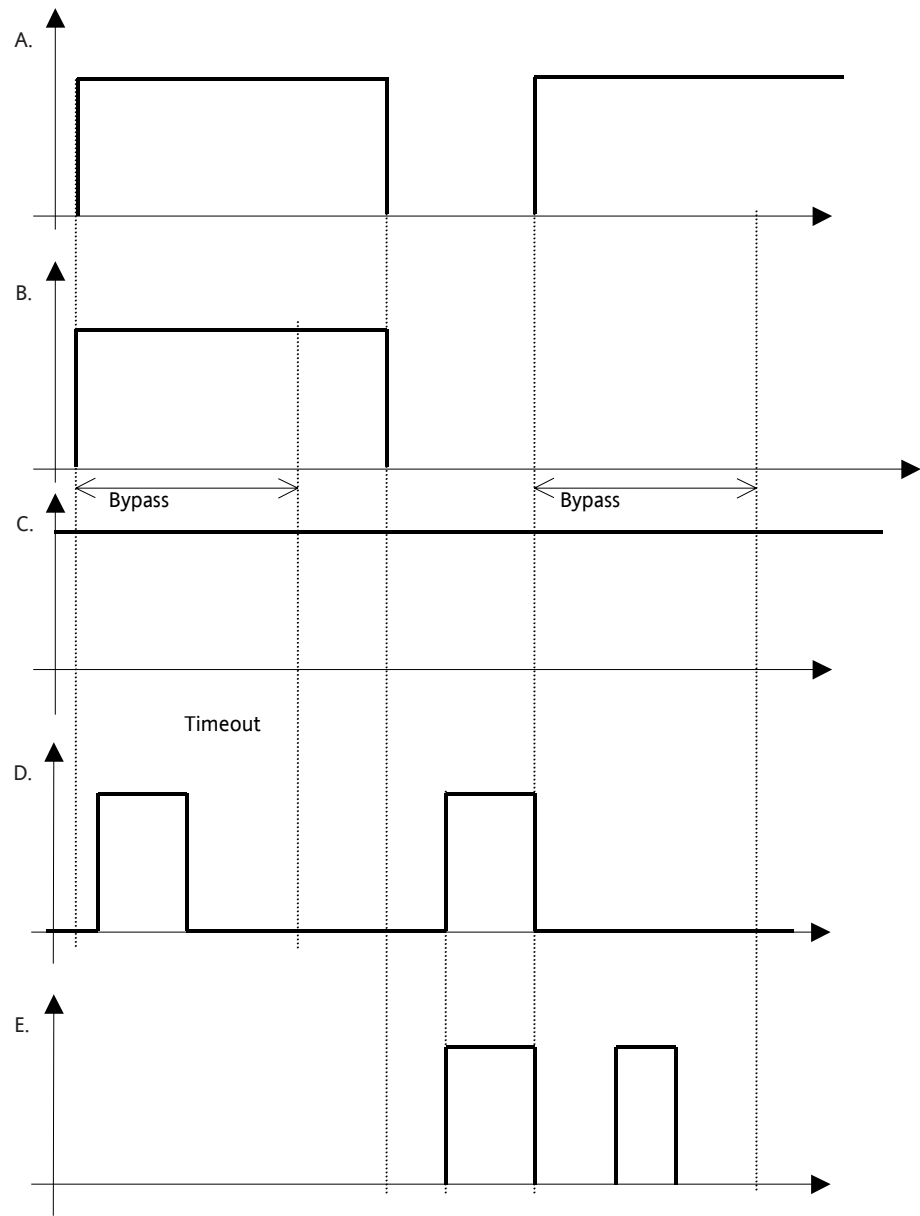
A.: Temperature control	B.: Compressor
C.: Solenoid valve (Up = Open)	D.: Pressure switch PD
E.: Minimum pressure pressure switch	F.: Automatic minimum pressure alarm

Example of minimum pressure alarm with *pump down* failed during the switching on of a compressor:



A.: Temperature control	B.: Compressor
C.: Solenoid valve (Up = Open)	D.: Pressure switch PD
E.: Minimum pressure pressure switch	F.: Automatic minimum pressure alarm

Example of minimum pressure alarm without *pump down* during the switching on of a compressor:



A.: Temperature control	B.: Compressor
C.: Solenoid valve (Up = Open)	D.: Minimum pressure pressure switch
E.: Automatic minimum pressure alarm	

9.4 Maximum pressure alarm of circuits

Maximum pressure in circuit 1
Maximum pressure in circuit 2
Maximum pressure in circuit 3
Maximum pressure in circuit 4
Maximum pressure in circuit 5
Maximum pressure in circuit 6
Maximum pressure in circuit 7
Maximum pressure in circuit 8

	Maximum pressure with probe
Reference parameter (*):	If CIRCUIT_INV_PRES_SENSOR_FLAG=TRUE <ul style="list-style-type: none">(CR01) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE (F)=1 (cooling)(CR03) COOLING LOW PRESSURE ALARM SENSOR PRESENCE (F)=1 (heating)

	If CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE
	• (CR07) COOLING HIGH PRESSURE ALARM SENSOR PRESENCE (F)=1
Parameter	(AP01) ALARMS: HIGH PRESSURE ALARM SET POINT (C)
Input status:	PMax pressure probe > (AP01) ALARMS: HIGH PRESSURE ALARM SET POINT(C)
Output status:	PMax pressure probe < (AP01) ALARMS: HIGH PRESSURE ALARM SET POINT(C) – (AP04) ALARMS: HIGH PRESSURE ALARM HYSTERESIS(C)
Actions:	Blocks the circuit
Reset:	Manual
Applicability:	Circuit

(*) The high pressure transducer of the circuit, when parameter CIRCUIT_INV_PRES_SENSOR_FLAG=FALSE fails to reverse when switching from Chiller to Pump mode, which means that the high pressure alarm is always generated by the same transducer.

	Maximum pressure with pressure switch
Reference parameter:	(CR04) COOLING HIGH PRESSURE ALARM DIGITAL INPUT PRESENCE (F) = 1
Input status:	Digital input (pressure switch) On
Output status:	Digital input (pressure switch) Off
Actions:	Blocks the circuit
Reset:	Manual
Applicability:	Circuit

9.5 Evaporator anti-freeze alarm

Anti-freeze of evaporator 1
Anti-freeze of evaporator 2
Anti-freeze of evaporator 3
Anti-freeze of evaporator 4

	Anti-freeze
Reference parameter:	(AF12) ANTIFREEZE: ALARM ENABLE (C) = 1
Input status:	*TOut < (AF01) ANTIFREEZE: ALARM TEMP SET POINT COOLING (C)
Output status:	*TOut > (AF01) ANTIFREEZE: ALARM TEMP SET POINT COOLING(C) + (AF09) ANTIFREEZE: ALARM TEMP HYSTERESIS COOLING(C)
Actions:	Blocks the machine and enables the <i>anti-freeze electric heaters</i> .
Reset:	Automatic, if the number of alarms per hour is below parameter (AF08) ANTIFREEZE: MAX NUM OF AUTOMATIC ALARMS(C); Manual, if the number of alarms per hour is above parameter (AF08) ANTIFREEZE: MAX NUM OF AUTOMATIC ALARMS(C)
Applicability:	Unit

Tout: evaporator output temperature

*In *Heating* mode the parameters are:

- (AF02) ANTIFREEZE: ALARM TEMP SET POINT HEATING (C)
- (AF10) ANTIFREEZE: ALARM TEMP HYSTERESIS HEATING (C)



The occurrence of an anti-freeze alarm on the evaporator blocks the evaporator and all the *circuits* connected to it.

The anti-freeze alarm is controlled both in the *Cooling* (chiller) and *Heating* modes and can be enabled with the following *Class C* parameter:

- (AF12) ANTIFREEZE: ALARM ENABLE

The anti-freeze alarm occurs when the temperature of the water output by the evaporator is below the temperature of the following *Class C* parameter:

- (AF01) ANTIFREEZE: ALARM TEMP SET POINT COOLING ((AF02) ANTIFREEZE: ALARM TEMP SET POINT HEATING).

The alarm condition ceases when the temperature rises above the value defined with the following *Class C* parameters:

- (AF01) ANTIFREEZE: ALARM TEMP SET POINT COOLING+(AF09) ANTIFREEZE: ALARM TEMP HYSTERESIS COOLING ((AF02) ANTIFREEZE: ALARM TEMP SET POINT HEATING+(AF10) ANTIFREEZE: ALARM TEMP HYSTERESIS HEATING).

The alarm is bypassed for the interval of time specified with the following *Class C* parameter:

- (AF06) ANTIFREEZE: ALARM BYPASS COOLING/ ((AF07) ANTIFREEZE: ALARM BYPASS HEATING).



The anti-freeze alarm is *reset* (if active) and bypassed when the mode changes and when the unit is switched from Off to On, both in local and remote mode.

The alarm is *reset* automatically. If the number of occurrences of the alarm per hour is equivalent to (AF08) ANTIFREEZE: MAX NUM OF AUTOMATIC ALARMS (both in *Heating* and Conditioning mode), the alarm is *reset* manually.

If the following *Class C* parameter:

- (AF13) ANTIFREEZE: ELECTRIC HEATER ENABLED ON ANTIFREEZE ALARMS

is active when the alarm occurs, the unit switches off and the anti-freeze electric heater are switched on.

The following [table](#) shows how controller Energy XT behaves when an anti-freeze alarm occurs, depending on the settings configured:

	Alarm signal	Enabling of anti-freeze electric heaters
(AF12) ANTIFREEZE: ALARM ENABLE = False (AF13) ANTIFREEZE: ELECTRIC HEATER ENABLED ON ANTIFREEZE ALARMS = False	No	No
(AF12) ANTIFREEZE: ALARM ENABLE = False (AF13) ANTIFREEZE: ELECTRIC HEATER ENABLED ON ANTIFREEZE ALARMS = True	No	No
(AF12) ANTIFREEZE: ALARM ENABLE = True (AF13) ANTIFREEZE: ELECTRIC HEATER ENABLED ON ANTIFREEZE ALARMS = False	Yes	No
(AF12) ANTIFREEZE: ALARM ENABLE = True (AF13) ANTIFREEZE: ELECTRIC HEATER ENABLED ON ANTIFREEZE ALARMS = True	Yes	Yes

9.5.1 Preventive anti-freeze

The [preventive anti-freeze](#) function enables the electric heater before the occurrence of anti-freeze alarm.

This function can be enabled by means of the following 4 [Class C](#) parameters:

- (AF14) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON COOLING](#) : Enables the function in Chiller mode
- (AF16) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON HEATING](#) : Enables the function in Heat Pump mode
- (AF15) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON DEFROST](#) : Enables the function in [Defrost](#) mode
- (AF17) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON STDBY/OFF](#) : Enables the function when the machine is Off or in [Standby](#)

In Chiller mode, the electric heaters are enabled when the temperature falls below the threshold set with the following [Class C](#) parameter:

- (AF03) [ANTIFREEZE: TEMP SET POINT COOLING](#)

In Heat Pump mode, the electric heaters are enabled when the temperature falls below the threshold set with the following [Class C](#) parameter:

- (AF04) [ANTIFREEZE: TEMP SET POINT HEATING](#)

The [hysteresis](#) is set close to the [set point](#), as determined by the following [Class C](#) parameter (which is valid both in both the Chiller and Heat Pump modes):

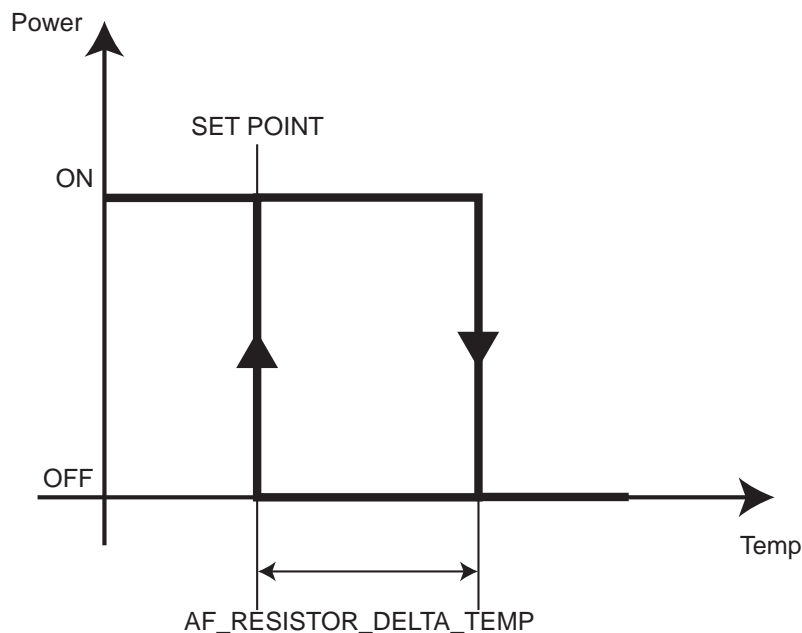
- (AF05) [ANTIFREEZE: TEMP HYSTERESIS](#)

If parameter (AF17) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON STDBY/OFF](#) is enabled, the function is active also when the machine is off or in [standby](#) mode. In this case the enabling [set point](#) corresponds to the [cooling set point](#) and uses the same control probe.

If parameter (AF15) [ANTIFREEZE: ELECTRIC HEATER ENABLED ON DEFROST](#) is enabled, the function will also be active in the [Defrost](#) mode.



The function can be enabled only if the [anti-freeze electric heaters](#) are present on the output of the evaporator ((AF11) [ANTIFREEZE: EVAPORATOR ELECTRIC HEATER PRESENCE](#)) (these have the same settings of the [integration electric heaters](#)).



SET POINT: (AF01) ANTIFREEZE: ALARM TEMP SET POINT COOLING or (AF02) ANTIFREEZE: ALARM TEMP SET POINT HEATING	Temp: Temperature
--	-------------------

9.5.2 Evaporator anti-freeze alarm of the secondary circuit

Anti-freeze of secondary circuit 1
 Anti-freeze of secondary circuit 2
 Anti-freeze of secondary circuit 3
 Anti-freeze of secondary circuit 4
 Anti-freeze of secondary circuit 5
 Anti-freeze of secondary circuit 6
 Anti-freeze of secondary circuit 7
 Anti-freeze of secondary circuit 8

The function of this alarm is the same as that of the [evaporator anti-freeze alarm](#) of the main circuit

9.6 Control of flow switch alarms

Flow switch alarm

Energy XT does not respond immediately to some flow switch alarms. The flow switch alarm, for example, must be enabled for a specific interval of time before it can be managed by Energy XT. In the following paragraphs, alarms are divided into "flow switch alarms" (that occur when the flow switch sends an alarm signal to the controller, but the latter has not yet reached the status "alarm from flow switch") and "logical alarms" (the controller has reached a status that allows it to control the alarms generated by the flow switch).

	Flow switch
Bypass parameter:	(PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME (C)
Bypass parameter:	(PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME (C)
Switching parameter:	(PP06) PUMPGROUP: FLOW SWITCH ALARM AUTO->MAN TIME (C)
Reset parameter:	(PP09) PUMPGROUP: FLOW SWITCH ALARM EXIT TIME (C)
Input status:	Digital input of main circuit
Output status:	Digital input of main circuit
Actions:	Switches all the compressors off. The water pumps continue to run to allow the alarm to be reset automatically. If no water continues to be supplied, the thermal switch of the water pump/s is enabled.
Reset:	Automatic/Manual
Applicability:	Unit

- (PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME defines the interval of time, from the pump start, during which the occurrence and presence of a flow switch alarm is bypassed. The alarm becomes active (i.e. becomes a logical alarm) if it persists after said interval of time has expired.

- (PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME defines the interval of time, during the ordinary operation of the pumps, during which the occurrence and presence of a flow switch alarm is bypassed. The alarm becomes active (i.e. becomes a logical alarm) if it persists after said interval of time has expired.
- (PP06) PUMPGROUP: FLOW SWITCH ALARM AUTO->MAN TIME defines for how long a logical alarm must be present before its control switches from automatic to manual.
- (PP09) PUMPGROUP: FLOW SWITCH ALARM EXIT TIME defines the minimum time that must expire before the alarm can be *reset* (automatically or manually). This interval of time is calculated from the time in which the cause of the flow switch alarm ceases.

Flow alarms control

With one pump or a group of pumps	If the flow switch alarm persists for an interval of time above that of (PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME (C), the unit switches off.
With two pumps or two groups of pumps	<p>If the flow alarm persists for an interval of time above that of (PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME(C):</p> <ul style="list-style-type: none"> • The compressors switch off if parameter (PP02) PUMPGROUP: PUMP ON - COMPRESSORS ON DELAY (C) is equivalent to 0 • A switching occurs on the pump • The rotation of hours is blocked • The timer of (PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME (C) is <i>reset</i> <p>If the alarm persists for an interval of time above (PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME (C), the unit blocks.</p> <p>If the alarm is disabled, a fault on pump n is signaled, where n represents the number of the pump that is switched off.</p>

- On standalone pumps, the flow switch alarm is always automatic.
- If the pumps are off, the digital input of the flow switch alarm is inactive.
- If pump n+1 is not available, the flow switch alarm with automatic *reset* is enabled, the unit switches off and pump n continues to run.

The pump/pumps switches/switch off if:

- A pump failure alarm and/or manually resettable flow switch alarm are active.
- A pump thermal alarm is active.

The pump/pumps does/do not switch off if:

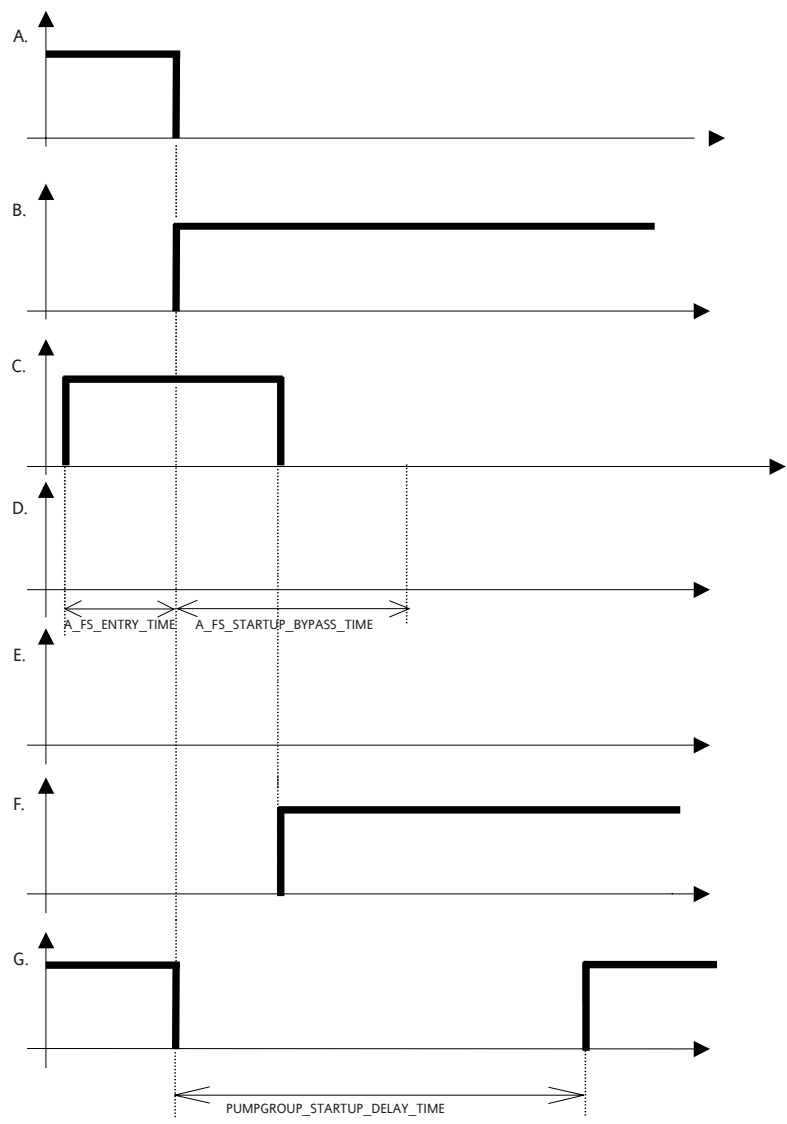
- An automatically resettable flow switch alarm is present although all the *circuits* are off. This enables the automatic *reset*. If the alarm persists, the pump thermal alarm is enabled.



On standalone pumps (condition determined by parameter (PP11) PUMPGROUP: CONTROL TYPE = Independent), the flow switch alarm is always automatically resettable.

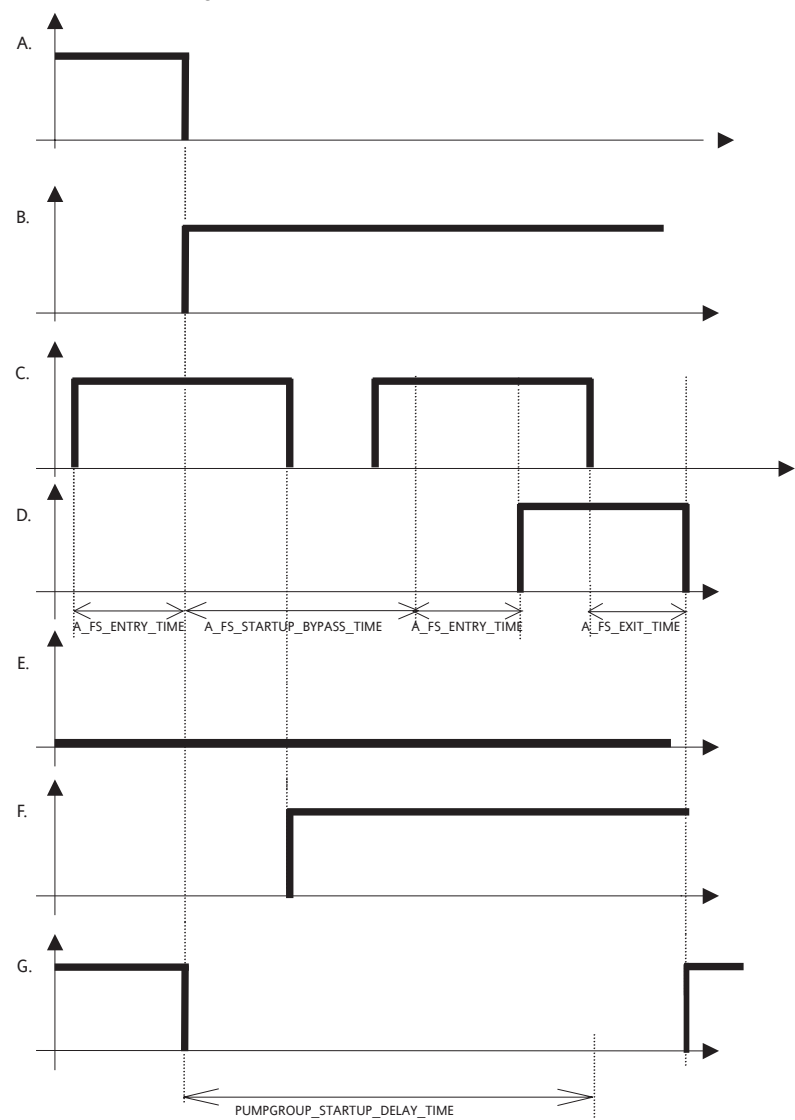
Example of flow switch alarm

Example of a flow switch alarm with *reset* alarm:



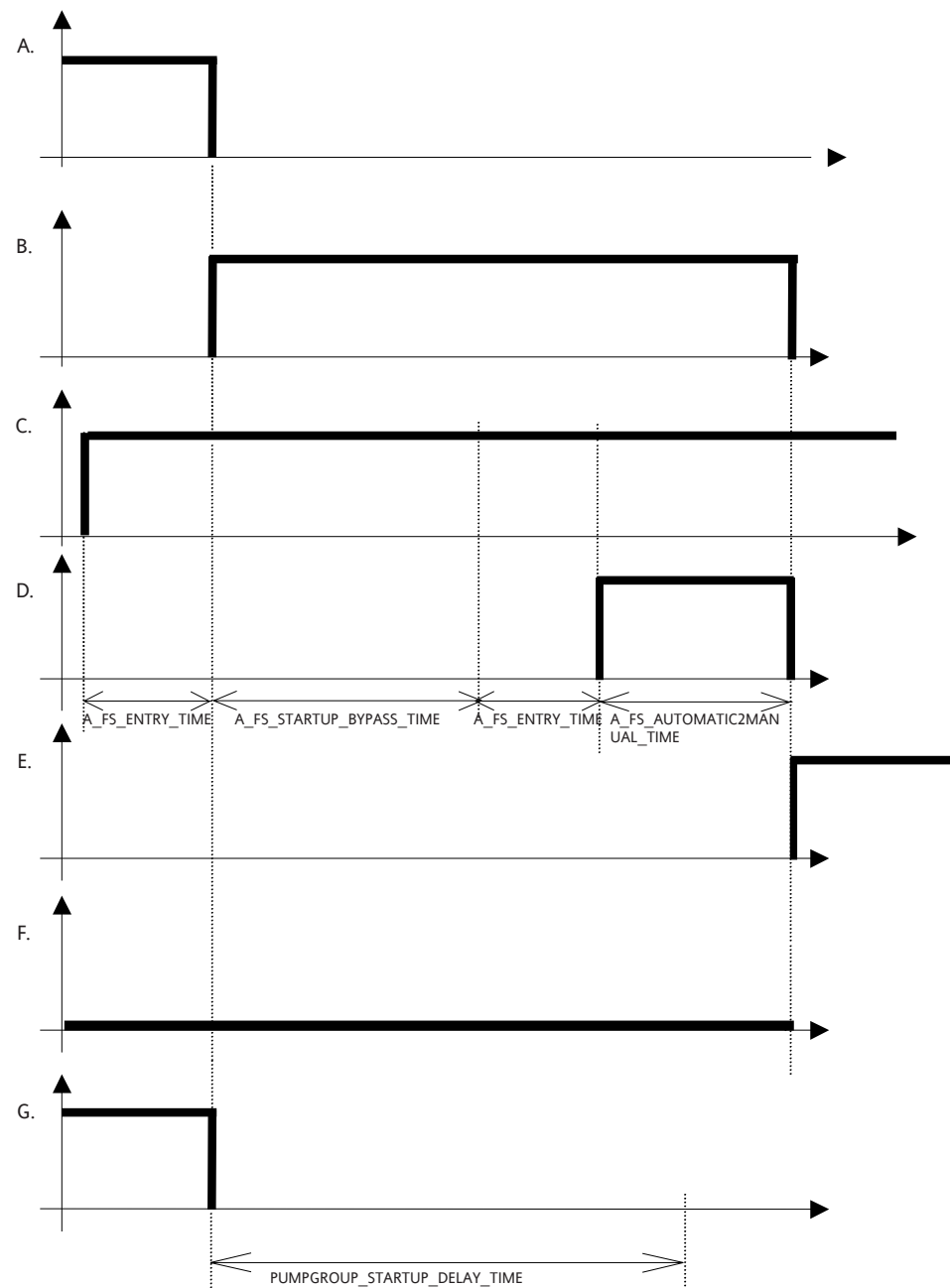
A.: Pump n	B.: Pump n+1
C.: Flow ID	D.: Automatic flow switch alarm
E.: Manual flow switch alarm	F.: Failure of pump n
G.: <i>Compressors</i>	

Example of flow switch alarm that resets and is again enabled:



A.: Pump n	B.: Pump n+1
C.: Flow ID	D.: Automatic flow switch alarm
E.: Manual flow switch alarm	F.: Failure of pump n
G.: Compressors	

Example of flow switch alarm that is not *reset*:



A.: Pump n	B.: Pump n+1
C.: Flow ID	D.: Automatic flow switch alarm
E.: Manual flow switch alarm	F.: Failure of pump n
G.: <i>Compressors</i>	

9.6.1 Water pump thermal alarm

Thermal switch of *pump group*

	Water pump thermal switch
Input status:	Digital input of the water pump thermal switch On
Output status:	Digital input of the water pump thermal switch Off
Actions:	Blocks the unit (see flow switch alarm)
<i>Reset:</i>	Manual
Applicability:	Unit

9.7 Free cooling pump thermal alarm

Free cooling pump thermal switch

	Free cooling pump thermal switch
Reference parameter:	(SY12) PUMP GROUP ENABLE(F) = 1
Input status:	Digital input of <i>free cooling pump</i> thermal switch On
Output status:	Digital input of <i>free cooling</i> thermal switch Off
Actions:	Blocks and disables the <i>free Cooling</i> mode
<i>Reset:</i>	Manual for the <i>free Cooling</i> mode Temperature control continues normally, as if the <i>Free Cooling</i> mode were disabled
Applicability:	Unit

9.8 Free cooling flow switch alarm

Free cooling flow switch

	Free cooling pump thermal switch
Reference parameter:	(SY12) PUMP GROUP ENABLE(F) = 1
Input status:	Digital input of <i>free cooling</i> flow switch On
Output status:	Digital input of <i>free cooling</i> flow switch Off
Actions:	Blocks and disables the <i>free Cooling</i> mode
<i>Reset:</i>	Manual
Applicability:	Unit

9.9 Heat recovery flow switch alarm

Heat recovery flow switch

	Free cooling pump thermal switch
Reference parameter:	(HR09) HEAT RECOVERY: FLOW SWITCH PRESENCE=1
Input status:	<ul style="list-style-type: none">• <i>Heat recovery</i> function enabled• The bypass time from the enabling of the <i>heat recovery</i> ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME) has expired• Digital input of the <i>heat recovery</i> circuit flow switch On• The bypass time of the alarm ((PP08) PUMPGROUP: FLOW SWITCH ALARM ENTRY TIME) has expired
Output status:	After disabling, the output waits for a bypass time equivalent to ((PP09) PUMPGROUP: FLOW SWITCH ALARM EXIT TIME
Actions:	Blocks and disables the <i>heat recovery</i> mode
<i>Reset:</i>	Manual
Applicability:	Unit



After start-up, the unit waits for an interval of time equivalent to (HR03) HEAT RECOVERY: MINIMUM TIME to prevent the immediate enabling of the *heat recovery* procedure.

9.10 Heat recovery pump thermal switch alarm

Heat recovery pump thermal switch

	Free cooling pump thermal switch
Reference parameter:	(HR10) HEAT RECOVERY: PUMP PRESENCE =1
Input status:	Digital input of the pump thermal switch of the secondary circuit On
Output status:	Digital input of the pump thermal switch of the secondary circuit Off
Actions:	Stops the system
<i>Reset:</i>	Manual
Applicability:	Unit

9.11 Unavailable pump alarm

Pump 0 unavailable
Pump 1 unavailable

	Unavailable pump alarm
Reference parameter:	(PP11) PUMPGROUP: CONTROL TYPE=INDIVIDUAL
Input status:	The alarm enables when a pump failure is detected after the enabling of the digital input of the flow switch of the main circuit. The pump stops and

	enters the alarm mode if the flow control is transferred to another available pump, which resumes the normal flow, after the enabling of this input. The following conditions must be met: The flow switch alarm must be in Automatic mode The bypass time from start-up ((PP07) PUMPGROUP: FLOW SWITCH ALARM BYPASS STARTUP TIME) must have expired
Output status:	
Actions:	Stops the system
Reset:	Manual
Applicability:	Unit

9.12 Water pump failure

	Water pump failure
Input status:	See flow switch alarm
Output status:	See flow switch alarm
Actions:	With one pump: blocks the unit With two pumps: enables the idle pump
Reset:	Manual
Applicability:	Unit

9.12.1 Water pump alarm control

With one pump	The whole unit switches off.
With two pumps	The pump switches and the rotation of hours stops. If the alarm occurs also on the second pump, the machine blocks. If the alarm cause ceases, a failure of pump *n (<i>manual reset</i>) is signaled. If all the pumps are off, the unit is blocked until the <i>manual reset</i> occurs *(where n represents the idle pump).

The flow switch alarm has an initial phase with automatic *reset*, which is controlled by parameter (PP06) PUMPGROUP: FLOW SWITCH ALARM AUTO->MAN TIME (C). Therefore, if this alarm ceases, only the pump failure (that can be *reset* manually) persists.

9.13 Control failure

Control failure

	Control failure
Enable	(DG07) ALARMS: EVAPORATOR TEMP ALARM ENABLE (C)
Input status:	<ul style="list-style-type: none"> Number of power steps currently generated by the system > 0 Tout – Tin < (DG01) ALARMS: EVAPORATOR TEMP ALARM SET POINT (H) * capacity steps supplied * 6 / max(1,((CP08) COMPRESSOR: NUMBER OF STAGE +1) *5))
Output status:	Tout – Tin > (DG01) ALARMS: EVAPORATOR TEMP ALARM SET POINT (H)
Actions:	Blocks the unit
Reset:	Manual
Applicability:	Unit

If the unit has more than one evaporator, Tout represents the average value of the temperatures output by single evaporators.

The cause of the alarm must persist for an interval of time above that of parameter (DG02) ALARMS: EVAPORATOR TEMP ALARM ALARM BYPASS (H) before the occurrence of the alarm.

9.14 High temperature alarm

High temperature

	High temperature alarm
Enable	(DG08) ALARMS: HIGH INLET TEMP ALARM ENABLE (C)
Input status:	T _{H2O} IN > (DG05) ALARMS: HIGH INLET TEMP ALARM SET POINT (H)
Output status:	T _{H2O} IN < (DG05) ALARMS: HIGH INLET TEMP ALARM SET POINT (H)
Actions:	Blocks the unit
Reset:	Manual
Applicability:	Unit

The high temperature is active only in the conditioning mode.

The alarm occurs when the temperature of the water input to the evaporator exceeds the value of parameter [A_HIGHT_THRESHOLD_TEMP](#) (H). The cause of the alarm must persist for an interval of time above that of parameter [\(DG03\) ALARMS: HIGH INLET TEMP ALARM BYPASS TIME](#) (H) before the occurrence of the alarm.

9.15 Low temperature alarm

Low temperature

	Low temperature alarm
Enable	(DG09) ALARMS: LOW INLET TEMP ALARM ENABLE (C)
Input status:	$T_{H2O} < \text{(DG06) ALARMS: LOW INLET TEMP ALARM SET POINT (H)}$
Output status:	$T_{H2O} > \text{(DG06) ALARMS: LOW INLET TEMP ALARM SET POINT (H)}$
Actions:	Blocks the unit
Reset:	Manual
Applicability:	Unit

The [low temperature alarm](#) is active only in HEAT PUMP mode.

The alarm occurs when the temperature of the water input to the evaporator is below the value of parameter [\(DG06\) ALARMS: LOW INLET TEMP ALARM SET POINT](#) (H). The cause of the alarm must persist for an interval of time above that of parameter [\(DG04\) ALARMS: LOW INLET TEMP ALARM BYPASS TIME](#) (H) before the occurrence of the alarm.

Note: the control alarm applies also to reversible heat pumps.

9.16 Automatic circuit alarm

Or automatic alarms of circuit 1-No pd
 Or automatic alarms of circuit 2-No pd
 Or automatic alarms of circuit 3-No pd
 Or automatic alarms of circuit 4-No pd
 Or automatic alarms of circuit 5-No pd
 Or automatic alarms of circuit 6-No pd
 Or automatic alarms of circuit 7-No pd
 Or automatic alarms of circuit 8-No pd

	Automatic circuit alarm
Input status:	<ul style="list-style-type: none"> Maximum pressure probe in alarm mode Minimum pressure probe in alarm mode The temperature probe on the condenser is in alarm mode if (FP06) FANS: CONDENSER TEMPERATURE SENSOR PRESENCE =1. One of the special temperature probes on the condenser is in alarm mode due to <i>defrost</i> if (DF12) DEFROST: CONDENSER DF ADDITIONAL TEMP SENSORS ENABLE>0. One of the special pressure probes on the condenser is in alarm mode due to <i>defrost</i> if (DF13) DEFROST: CONDENSER DF ADDITIONAL PRESS SENSORS ENABLE>0.
Output status:	$T_{H2O} > \text{(DG06) ALARMS: LOW INLET TEMP ALARM SET POINT (H)}$
Actions:	Blocks the circuit
Reset:	Automatic
Applicability:	Unit

The [low temperature alarm](#) is active only in HEAT PUMP mode.

The alarm occurs when the temperature of the water input to the evaporator is below the value of parameter [\(DG06\) ALARMS: LOW INLET TEMP ALARM SET POINT](#) (H). The cause of the alarm must persist for an interval of time above that of parameter [\(DG04\) ALARMS: LOW INLET TEMP ALARM BYPASS TIME](#) (H) before the occurrence of the alarm.

Note: the control alarm applies also to reversible heat pumps.

9.17 Automatic circuit pump down alarm

Or automatic pd alarms of circuit 1
 Or automatic pd alarms of circuit 2
 Or automatic pd alarms of circuit 3
 Or automatic pd alarms of circuit 4
 Or automatic pd alarms of circuit 5
 Or automatic pd alarms of circuit 6
 Or automatic pd alarms of circuit 7
 Or automatic pd alarms of circuit 8

	Circuit pump down alarm
Input status:	<ul style="list-style-type: none"> The alarm enables when the length of the pump down procedure after start up is equivalent to > (PD03) PUMPDOWN: OFF-ON MAX TIME or when the length of the pump down after switch off is > (PD04) PUMPDOWN: ON-OFF MAX TIME.
Output status:	

Actions:	Signal only
Reset:	
Applicability:	Unit

9.18 Probe errors

The probe error occurs only if the probe is shorted or open (this condition is generically referred to as "Values out of [range](#)" in sections "Input status" and "Output status").

Energy XT checks the operation of all the probes of the system, blocking the faulty component and performing the alarm action associated to the probe if an error condition is detected on the probe.



The probe error does not occur if an alarm controlled by a probe is disabled.

9.19 Compressor probe error alarm

Or [probe errors](#) of compressor 1
 Or [probe errors](#) of compressor 2
 Or [probe errors](#) of compressor 3
 Or [probe errors](#) of compressor 4
 Or [probe errors](#) of compressor 5
 Or [probe errors](#) of compressor 6
 Or [probe errors](#) of compressor 7
 Or [probe errors](#) of compressor 8

	Compressor probe alarm
Input status:	<ul style="list-style-type: none"> Se (CP16) COMPRESSOR: OIL PRESSURE SENSOR PRESENCE=1 (oil pressure sensor) the alarm enables if an error occurs on the compressor oil pressure probe and (CP22) COMPRESSOR: DIFFERENTIAL ALARM ENABLE=1. If (CP14) COMPRESSOR: DISCHARGE TEMP ALARM SENSOR TYPE=SENSOR (presence of compressor discharge temperature alarm), the alarm enables if an error occurs on the compressor discharge temperature probe and (CP21) COMPRESSOR: DISCHARGE TEMP ALARM ENABLE=1.
Output status:	
Actions:	Blocks the compressor
Reset:	Automatic
Applicability:	Unit

9.20 Anti-freeze probe error alarm

Error on anti-freeze probe of evaporator 1
 Error on anti-freeze probe of evaporator 2
 Error on anti-freeze probe of evaporator 3
 Error on anti-freeze probe of evaporator 4

	Anti-freeze probe alarm
Enable	(AF12) ANTIFREEZE: ALARM ENABLE = 1
Input status:	The alarm is active if an error occurs on the output temperature probe of the main evaporator circuit.
Output status:	
Actions:	Blocks the system
Reset:	Automatic
Applicability:	Unit

9.21 Alarm due to heat recovery input temperature probe error

[Heat recovery](#) input temperature probe

	Heat recovery input temperature probe alarm
Enable	(HR11) HEAT RECOVERY: TEMPERATURE SENSOR PRESENCE = 1
Input status:	The alarm is active if an error occurs on the heat recovery input temperature probe.
Output status:	
Actions:	Blocks the recovery function
Reset:	Automatic
Applicability:	Unit

9.22 Temperature control probe error alarm

Temperature control probe error

	Temperature control probe alarm
Enable	(HR11) <i>HEAT RECOVERY: TEMPERATURE SENSOR</i> PRESENCE = 1
Input status:	<ul style="list-style-type: none">• If <i>(ST08) DYNAMIC TSET: THERMAL REGULATION SENSOR</i>=ENTRY_SENSOR, the alarm is active if an error occurs on the input temperature probe of the main circuit.• If <i>(ST08) DYNAMIC TSET: THERMAL REGULATION SENSOR</i>=EXIT_SENSOR, the alarm enables:<ul style="list-style-type: none">◦ If <i>(ST10) TEMP SENSOR SHARED FOR EVAPORATORS ENABLE</i>=1 (Shared output sensor of main circuit present), the alarm enables if an error occurs on the shared output temperature probe of the main circuit.◦ If <i>(ST10) TEMP SENSOR SHARED FOR EVAPORATORS ENABLE</i>=0, the alarm enables if an error occurs in one of the main output temperature probes.
Output status:	
Actions:	Blocks the system
<i>Reset:</i>	Automatic
Applicability:	Unit

9.23 Free cooling probe error alarm

Free cooling probe

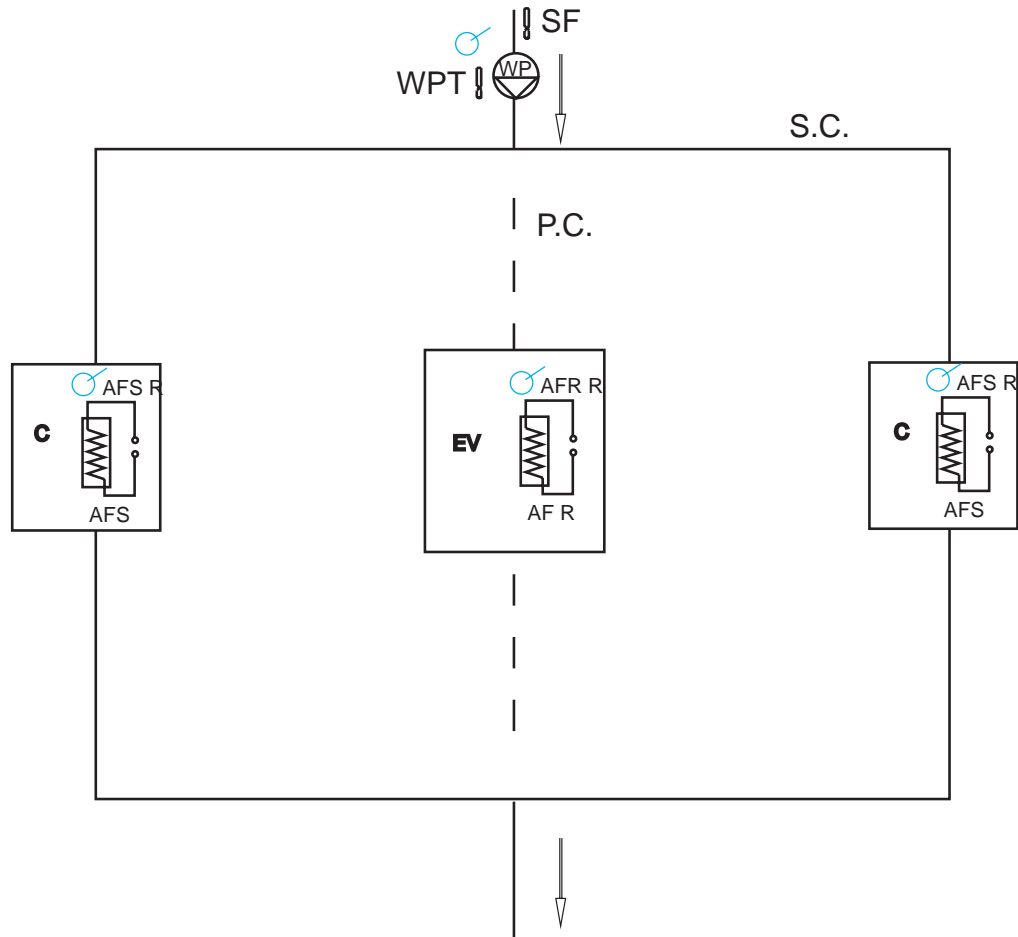
	<i>Free cooling</i> probe alarm
Enable	<i>(FC04) FREECOOLING: SENSOR</i> >0 (<i>Free cooling</i> external temperature probe present)
Input status:	The alarm is active if an error occurs on the <i>free cooling</i> external temperature probe.
Output status:	
Actions:	Blocks the <i>free cooling</i> function
<i>Reset:</i>	Automatic
Applicability:	Unit

10 WATER WATER DEVICES

Energy XT is able to manage water/water units.

In this case, the system is equipped with a secondary circuit for the circulation of water, but requires no fans, controls or *defrost* procedures.

Example of a system layout



P.C.: Main circuit	S.C.: Secondary circuit
WP: <i>Water pump of secondary circuit</i>	C: Condenser block
EV: Evaporator block	SF: Flow switch
AFR: <i>Anti-freeze electric heaters</i> of main circuit	AFS: <i>Anti-freeze electric heaters</i> of secondary circuit
WPT: Thermal switch probe of secondary circuit water pump	AFRR: Relays of <i>anti-freeze electric heaters</i> of main circuit
AFSR: Relays of <i>anti-freeze electric heaters</i> of secondary circuit	

To be able to manage water/water units, it is necessary to set to 1 the following *Class F* parameter:

- *(SY15) MACHINE TYPE* (0: Water/Air; 1: Water/Water)

Water pump of secondary circuit

The water circulation pump of the secondary circuit is always active if the unit is on, even if the *circuits* are off. The pump switches off when the unit is off.

Only one pump is present in the system. Maximum pressure (chiller)/minimum pressure alarms of the secondary circuit switch the related circuit off with the same procedures of the water/air units.

Water/water units are able to control the *anti-freeze alarm of the secondary circuit* and enable the anti-freeze electric heater of the secondary circuit with the same procedures used for the anti-freeze alarm of the main circuit (see next subchapter).

10.1 Anti-freeze alarm of the secondary circuit

Anti-freeze alarm conditions of the secondary circuit can be controlled both in the *Cooling* (chiller) and *Heating* modes.

The control can be enabled with the following *Class C* parameter:

(AF24) ANTIFREEZE 2: ALARM DETECTION ENABLE

The anti-freeze alarm occurs when the temperature of the water output by one of the heat exchangers is below the temperature specified by the following *Class C* parameter:

(AF18) ANTIFREEZE 2: ALARM TEMP *SET POINT COOLING* ((AF19) ANTIFREEZE 2: ALARM TEMP *SET POINT HEATING*).

The alarm condition ceases when the temperature of the water output from all heat exchangers rises above the value of the following *Class C* parameters:

(AF18) ANTIFREEZE 2: ALARM TEMP *SET POINT COOLING*+(AF22) *ANTIFREEZE 2: ALARM TEMP HYSTERSIS HEATING*

((AF19) ANTIFREEZE 2: ALARM TEMP *SET POINT HEATING* + (AF23) *ANTIFREEZE 2: ALARM TEMP HYSTERSIS COOLING*)

The alarm is bypassed for the interval of time expressed by the following *Class C* parameter:

(AF20) *ANTIFREEZE 2: BYPASS ALARM COOLING* ((AF21) *ANTIFREEZE 2: BYPASS ALARM HEATING*)

Calculated from the powering on of the first compressor of the related circuit.

The alarm is *reset* automatically.

If the number of occurrences of the alarm per hour is equivalent to the value expressed by the following *Class C* parameter:

(AF25) *ANTIFREEZE 2: MAX NUM OF AUTOMATIC ALARMS*

The alarm becomes manually resettable.

The unit switches off as soon as an alarm occurs.

If the following *Class C* parameter:

(AF27) *ANTIFREEZE 2: ELECTRIC HEATER ON ALARM* =1

The *anti-freeze electric heaters* switch on.

However, the electric heaters do not switch on if (AF27) *ANTIFREEZE 2: ELECTRIC HEATER ON ALARM* =0

11 PARAMETERS TABLE

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Configuration parameters						
(Cg01) Main Board digital Inputs Low Voltage	1	14	14	Num		C
(Cg02) Main Board digital Inputs High Voltage	0	4	0	Num		C
(Cg03) Main Board digital Inputs Mixed High/Low	0	1	0	Num		C
(Cg04) Language	0	1	0	Num		H
(Cg05) RTC Enable	0	1	1	Flag		H
(Cg06) On Off Remote Enable	0	1	0	Flag	0=SIGNAL_OFF, 1=SIGNAL_ON	C
(Cg07) Machine Reversal Remote Enable	0	1	0	Flag		H
(Cg08) Events Enable	0	1	0	Flag		H
(Cg09) Events Type	0	2	0	Num	0=TB_TYPE_DAILY, 1=TB_TYPE_WEEKLY 2=TB_TYPE_FIVE_PLUS_TWO	H
(Cg10) Menu Timeout	10	1000	120	Sec		H
(Cg11) Plant Mode Manual	0	1	0	Flag		H
(Cg12) Config Password	0	5	AAAAA	String		H
(Cg13) Partialization Mode	0	1	0	Flag	0=PARZTYPE_SEMI-SEALED, 1=PARTTYPE_SCREW	C
(Cg14) Dynamic I/O Allocation	0	1	1	Num		H
(Cg15) User ID (1st Part)	0	20		String		H
(Cg16) User ID (2nd Part)	0	20		String		H
(Cg17) BLACK BOX Enable	0	1	1	Num		H
(Cg18) BLACK BOX Delay	0	20	0	Num		H
(Cg19) BLACK BOX Time Between Samples	30	250	30	Sec		H
(Cg20) Delta Start T1	0,1	60	1	Sec		H
(Cg21) Delta Start T2	50	250	50	Num		H
Base configuration parameter						
(Bc01) Main Board (MB) Type	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(Bc02) Main Board (MB) Enabling	0	1	0	Num		C
(Bc03) Main Board (MB) UM	0	1	0	Num		H
(Bc04) (MB) Probes AI1...AI4 Type	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1,	H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
					2=P0123_PTC_KTY81,	
(Bc05) (MB) Probes AI5 AI6 Type	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA,	H
(Bc06) (MB) Probes AI7 AI8 Type	0	3	3	Num		H
(Bc07) (MB) Offset Probe AI1	-10	10	0	Num		H
(Bc08) (MB) Offset Probe AI2	-10	10	0	Num		H
(Bc09) (MB) Offset Probe AI3	-10	10	0	Num		H
(Bc10) (MB) Offset Probe AI4	-10	10	0	Num		H
(Bc11) (MB) Offset Probe AI5	-10	10	0	Num		H
(Bc12) (MB) Offset Probe AI6	-10	10	0	Num		H
(Bc13) (MB) Offset Probe AI7	-10	10	0	Num		H
(Bc14) (MB) Offset Probe AI8	-10	10	0	Num		H
(Bc15) (MB) Pressure Value 4mA Probe AI5	-1	1	0	Bar		H
(Bc16) (MB) Pressure Value 20mA Probe AI5	1	100	30	Bar		H
(Bc17) (MB) Pressure Value 4mA Probe AI6	-1	1	0	Bar		H
(Bc18) (MB) Pressure Value 20mA Probe AI6	1	100	30	Bar		H
(Bc19) (MB) Pressure Value 4mA Probe AI7	-1	1	0	Bar		H
(Bc20) (MB) Pressure Value 20mA Probe AI7	1	100	30	Bar		H
(Bc21) (MB) Pressure Value 4mA Probe AI8	-1	1	0	Bar		H
(Bc22) (MB) Pressure Value 20mA Probe AI8	1	100	30	Bar		H
Exp0 configuration parameters						
(X001) INTERNAL EXPANSION (IE) TYPE	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(X002) INTERNAL EXPANSION (IE) ENABLING	0	1	0	Num		C
(X003) INTERNAL EXPANSION (IE) UM	0	1	0	Num		H
(X004) (IE) PROBES AI13...AI6 TYPE	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1, 2=P0123_PTC_KTY81,	H
(X005) (IE) PROBES AI9 AI10 TYPE	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA,	H
(X006) (IE) PROBES AI11 AI12 TYPE	0	3	3	Num		H
(X007) (IE) OFFSET PROBE AI13	-10	10	0	Num		H
(X008) (IE) OFFSET PROBE AI14	-10	10	0	Num		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(X009) (IE) OFFSET PROBE AI15	-10	10	0	Num		H
(X010) (IE) OFFSET PROBE AI16	-10	10	0	Num		H
(X011) (IE) OFFSET PROBE AI9	-10	10	0	Num		H
(X012) (IE) OFFSET PROBE AI10	-10	10	0	Num		H
(X013) (IE) OFFSET PROBE AI11	-10	10	0	Num		H
(X014) (IE) OFFSET PROBE AI12	-10	10	0	Num		H
(X015) (IE) PRESSURE VALUE 4MA PROBE AI9	-1	1	0	Bar		H
(X016) (IE) PRESSURE VALUE 20MA PROBE AI9	1	100	30	Bar		H
(X017) (IE) PRESSURE VALUE 4MA PROBE AI10	-1	1	0	Bar		H
(X018) (IE) PRESSURE VALUE 20MA PROBE AI10	1	100	30	Bar		H
(X019) (IE) PRESSURE VALUE 4MA PROBE AI11	-1	1	0	Bar		H
(X020) (IE) PRESSURE VALUE 20MA PROBE AI11	1	100	30	Bar		H
(X021) (IE) PRESSURE VALUE 4MA PROBE AI12	-1	1	0	Bar		H
(X022) (IE) PRESSURE VALUE 20MA PROBE AI12	1	100	30	Bar		H
Exp1 configuration parameters						
(X101) EXPANSION #1 (EXP #1) TYPE	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(X102) EXPANSION #1 (EXP #1) ENABLING	0	1	0	Num		C
(X103) EXPANSION #1 (EXP #1) UT	0	1	0	Num		H
(X104) (EXP #1) PROBES AI1...AI4 TYPE DUMMY	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1, 2=P0123_PTC_KTY81,	H
(X105) (EXP #1) PROBES AI1 AI2 TYPE	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA,	H
(X106) (EXP #1) PROBES AI3 AI4 TYPE	0	3	3	Num		H
(X107) (EXP #1) OFFSET PROBE AI1 DUMMY	-10	10	0	Num		H
(X108) (EXP #1) OFFSET PROBE AI2 DUMMY	-10	10	0	Num		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(X109) (EXP #1) OFFSET PROBE AI3DUMMY	-10	10	0	Num		H
(X110) (EXP #1) OFFSET PROBE AI4 DUMMY	-10	10	0	Num		H
(X111) (EXP #1) OFFSET PROBE AI1	-10	10	0	Num		H
(X112) (EXP #1) OFFSET PROBE AI2	-10	10	0	Num		H
(X113) (EXP #1) OFFSET PROBE AI3	-10	10	0	Num		H
(X114) (EXP #1) OFFSET PROBE AI4	-10	10	0	Num		H
(X115) (EXP #1) PRESSURE VALUE 4MA PROBE AI1	-1	1	0	Bar		H
(X116) (EXP #1) PRESSURE VALUE 20MA PROBE AI1	1	100	30	Bar		H
(X117) (EXP #1) PRESSURE VALUE 4MA PROBE AI2	-1	1	0	Bar		H
(X118) (EXP #1) PRESSURE VALUE 20MA PROBE AI2	1	100	30	Bar		H
(X119) (EXP #1) PRESSURE VALUE 4MA PROBE AI3	-1	1	0	Bar		H
(X120) (EXP #1) PRESSURE VALUE 20MA PROBE AI3	1	100	30	Bar		H
(X121) (EXP #1) PRESSURE VALUE 4MA PROBE AI4	-1	1	0	Bar		H
(X122) (EXP #1) PRESSURE VALUE 20MA PROBE AI4	1	100	30	Bar		H
Exp2 configuration parameters						
(X201) EXPANSION #2 (EXP #2) TYPE	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(X202) EXPANSION #2 (EXP #2) ENABLING	0	1	0	Num		C
(X203) EXPANSION #2 (EXP #2) UT	0	1	0	Num		H
(X204) (EXP #2) PROBES AI1...AI4 TYPE DUMMY	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1, 2=P0123_PTC_KTY81,	H
(X205) (EXP #2) PROBES AI1 AI2 TYPE	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA,	H
(X206) (EXP #2) PROBES AI3 AI4 TYPE	0	3	3	Num		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(X207) (EXP #2) OFFSET PROBE AI1 DUMMY	-10	10	0	Num		H
(X208) (EXP #2) OFFSET PROBE AI2 DUMMY	-10	10	0	Num		H
(X209) (EXP #2) OFFSET PROBE AI3DUMMY	-10	10	0	Num		H
(X210) (EXP #2) OFFSET PROBE AI4 DUMMY	-10	10	0	Num		H
(X211) (EXP #2) OFFSET PROBE AI1	-10	10	0	Num		H
(X212) (EXP #2) OFFSET PROBE AI2	-10	10	0	Num		H
(X213) (EXP #2) OFFSET PROBE AI3	-10	10	0	Num		H
(X214) (EXP #2) OFFSET PROBE AI4	-10	10	0	Num		H
(X215) (EXP #2) PRESSURE VALUE 4MA PROBE AI1	-1	1	0	Bar		H
(X216) (EXP #2) PRESSURE VALUE 20MA PROBE AI1	1	100	30	Bar		H
(X217) (EXP #2) PRESSURE VALUE 4MA PROBE AI2	-1	1	0	Bar		H
(X218) (EXP #2) PRESSURE VALUE 20MA PROBE AI2	1	100	30	Bar		H
(X219) (EXP #2) PRESSURE VALUE 4MA PROBE AI3	-1	1	0	Bar		H
(X220) (EXP #2) PRESSURE VALUE 20MA PROBE AI3	1	100	30	Bar		H
(X221) (EXP #2) PRESSURE VALUE 4MA PROBE AI4	-1	1	0	Bar		H
(X222) (EXP #2) PRESSURE VALUE 20MA PROBE AI4	1	100	30	Bar		H
Exp3 configuration parameters						
(X301) EXPANSION #3 (EXP #3) TYPE	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(X302) EXPANSION #3 (EXP #3) ENABLING	0	1	0	Num		C
(X303) EXPANSION #3 (EXP #3) UT	0	1	0	Num		H
(X304) (EXP #3) PROBES AI1...AI4 TYPE DUMMY	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1, 2=P0123_PTC_KTY81,	H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(X305) (EXP #3) PROBES AI1 AI2 TYPE	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA.	H
(X306) (EXP #3) PROBES AI3 AI4 TYPE	0	3	3	Num		H
(X307) (EXP #3) OFFSET PROBE AI1 DUMMY	-10	10	0	Num		H
(X308) (EXP #3) OFFSET PROBE AI2 DUMMY	-10	10	0	Num		H
(X309) (EXP #3) OFFSET PROBE AI3DUMMY	-10	10	0	Num		H
(X310) (EXP #3) OFFSET PROBE AI4 DUMMY	-10	10	0	Num		H
(X311) (EXP #3) OFFSET PROBE AI1	-10	10	0	Num		H
(X312) (EXP #3) OFFSET PROBE AI2	-10	10	0	Num		H
(X313) (EXP #3) OFFSET PROBE AI3	-10	10	0	Num		H
(X314) (EXP #3) OFFSET PROBE AI4	-10	10	0	Num		H
(X315) (EXP #3) PRESSURE VALUE 4MA PROBE AI1	-1	1	0	Bar		H
(X316) (EXP #3) PRESSURE VALUE 20MA PROBE AI1	1	100	30	Bar		H
(X317) (EXP #3) PRESSURE VALUE 4MA PROBE AI2	-1	1	0	Bar		H
(X318) (EXP #3) PRESSURE VALUE 20MA PROBE AI2	1	100	30	Bar		H
(X319) (EXP #3) PRESSURE VALUE 4MA PROBE AI3	-1	1	0	Bar		H
(X320) (EXP #3) PRESSURE VALUE 20MA PROBE AI3	1	100	30	Bar		H
(X321) (EXP #3) PRESSURE VALUE 4MA PROBE AI4	-1	1	0	Bar		H
(X322) (EXP #3) PRESSURE VALUE 20MA PROBE AI4	1	100	30	Bar		H
Exp4 configuration parameters						
(X401) EXPANSION #4 (EXP #4) TYPE	0	4	0	Num	0=XTM, 1=XTE1, 2=XTE1H	C
(X402) EXPANSION #4 (EXP #4) ENABLING	0	1	0	Num		C
(X403) EXPANSION #4 (EXP #4) UT	0	1	0	Num		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(X404) (EXP #4) PROBES AI1...AI4 TYPE DUMMY	0	2	0	Num	0=P0123_NTC_103AT, 1=P0123_NTC_NK103C1R1, 2=P0123_PTC_KTY81,	H
(X405) (EXP #4) PROBES AI1 AI2 TYPE	0	3	3	Num	0=P45_NTC_103AT, 1=P45_NTC_NK103C1R1, 2=P45_PTC_KTY81, 3=P45_PRESSURE_4_20_MA,	H
(X406) (EXP #4) PROBES AI3 AI4 TYPE	0	3	3	Num		H
(X407) (EXP #4) OFFSET PROBE AI1 DUMMY	-10	10	0	Num		H
(X408) (EXP #4) OFFSET PROBE AI2 DUMMY	-10	10	0	Num		H
(X409) (EXP #4) OFFSET PROBE AI3DUMMY	-10	10	0	Num		H
(X410) (EXP #4) OFFSET PROBE AI4 DUMMY	-10	10	0	Num		H
(X411) (EXP #4) OFFSET PROBE AI1	-10	10	0	Num		H
(X412) (EXP #4) OFFSET PROBE AI2	-10	10	0	Num		H
(X413) (EXP #4) OFFSET PROBE AI3	0	10	0	Num		H
(X414) (EXP #4) OFFSET PROBE AI4	-10	10	0	Num		H
(X415) (EXP #4) PRESSURE VALUE 4MA PROBE AI1	-1	1	0	Bar		H
(X416) (EXP #4) PRESSURE VALUE 20MA PROBE AI1	1	100	30	Bar		H
(X417) (EXP #4) PRESSURE VALUE 4MA PROBE AI2	-1	1	0	Bar		H
(X418) (EXP #4) PRESSURE VALUE 20MA PROBE AI2	1	100	30	Bar		H
(X419) (EXP #4) PRESSURE VALUE 4MA PROBE AI3	-1	1	0	Bar		H
(X420) (EXP #4) PRESSURE VALUE 20MA PROBE AI3	1	100	30	Bar		H
(X421) (EXP #4) PRESSURE VALUE 4MA PROBE AI4	-1	1	0	Bar		H
(X422) (EXP #4) PRESSURE VALUE 20MA PROBE AI4	1	100	30	Bar		H
uarts configuration parameters						
(Cm01) FAA Address	0	14	0	Num		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Cm02) VIS MOD	-32768	32768	1025	Num		H
(Cm03) PCH	-32768	32768	7	Num		H
(Cm04) CRC	0	20		String		H
Cm05						H
Cm06						H
Cm07						H
Cm08						H
(Cm09) Modem Enable	0	1	0	Flag		H
(Cm10) Init String (1st part)	0	20		String		H
(Cm11) Init String (2nd part)	0	20		String		H
(Cm12) HangUp String	0	20	ATH0	String		H
(Cm13) Phone Number (to dial)	0	20		String		H
(Cm14) BLACK BOX Memory Full Call Enable Enable	0	1	0	Flag		H
(Cm15) Manual Alarms Call Enable	0	1	0	Flag		H
(Cm16) Automatic Alarms Call Enable	0	1	0	Flag		H
(Cm17) Bounded Alarms Call Enable	0	1	0	Flag		H
(Cm18) System Alarms Call Enable	0	1	0	Flag		H
(Cm19) Daily Call Enable	0	1	0	Flag		H
(Cm20) Number or Retries	1	10	3	Num		H
(Cm21) Delay on Retry	1	100	10	Min		H
(Cm22) Daily Call Time (Hour)	0	23	0	Num		H
(Cm23) Daily Call Time (Min)	0	59	0	Num		H
(Cm24) COM1 Protocol Type	2	3	2	Num	2=MICRONET, 3=MODBUS_RTU	H
(Cm25) COM1 Baud Rate	0	2	0	Num	0=BAUD_9600, 1=BAUD_19200, 2=BAUD_38400	H
(Cm26) COM1 Parity	0	2	1	Num	0=PARITY_NULL, 1=PARITY_ODD, 2=PARITY_EVEN	H
(Cm27) COM2 Protocol Type	0	5	0	Num	0=TELEVIS, 1=TELEVISforMODEM, 2=MICRONET, 3=MODBUS_RTU, 4=MODBUS_ASCII, 5=CVMforMODEM	H
(Cm28) COM2 Baud Rate	0	2	1	Num	0=BAUD_9600, 1=BAUD_19200, 2=BAUD_38400	H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Cm29) COM2 Parity	0	2	2	Num	0=PARITY_NULL, 1=PARITY_ODD, 2=PARITY_EVEN	H
(Cm30) COM2 Data Length	0	1	1	Flag	0=7_DATA_BITS, 1=8_DATA_BITS	H
(Cm31) COM2 RTS Handling Enable	0	1	0	Flag		H
Time band parameters - Monday						
(H001) MONDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H002) MONDAY EVENT #1 HOUR	0	23	0	Hours		H
(H003) MONDAY EVENT #1 MIN	0	59	0	Min		H
(H004) MONDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H005) MONDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H006) MONDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H007) MONDAY EVENT #2 ENABLE	0	1	0	Flag		H
((H008) MONDAY EVENT #2 MIN) MONDAY EVENT #2 HOUR	0	23	0	Hours		H
((H008) MONDAY EVENT #2 MIN) MONDAY EVENT #2 HOUR	0	59	0	Min		H
(H009) MONDAY EVENT #2 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H010) MONDAY EVENT #2 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H011) MONDAY EVENT #2 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H012) MONDAY EVENT #3 ENABLE	0	1	0	Flag		H
(H013) MONDAY EVENT #3 HOUR	0	23	0	Hours		H
(H014) MONDAY EVENT #3 MIN	0	59	0	Min		H
(H015) MONDAY EVENT #3 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H016) MONDAY EVENT #3 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H017) MONDAY EVENT #3 HEATPUMP SET	-50	150	40	°C/°F		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
TEMP						
(H018) MONDAY EVENT #4 ENABLE	0	1	0	Flag		H
(H019) MONDAY EVENT #4 HOUR	0	23	0	Hours		H
(H020) MONDAY EVENT #4 MIN	0	59	0	Min		H
(H021) MONDAY EVENT #4 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H022) MONDAY EVENT #4 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H023) MONDAY EVENT #4 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Tuesday						
(H101) TUESDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H102) TUESDAY EVENT #1 HOUR	0	23	0	Hours		H
(H103) TUESDAY EVENT #1 MIN	0	59	0	Min		H
(H104) TUESDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H105) TUESDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H106) TUESDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H107) TUESDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H108) TUESDAY EVENT #2 HOUR	0	23	0	Hours		H
(H108) TUESDAY EVENT #2 HOUR	0	59	0	Min		H
(H109) TUESDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H110) TUESDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H111) TUESDAY EVENT #2 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H112) TUESDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H113) TUESDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H114) TUESDAY EVENT #3 HOUR	0	59	0	Min		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(H115) TUESDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H116) TUESDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H117) TUESDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H118) TUESDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H
(H119) TUESDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H120) TUESDAY EVENT #4 HOUR	0	59	0	Min		H
(H121) TUESDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H122) TUESDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H123) TUESDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Wednesday						
(H201) WEDNESDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H202) WEDNESDAY EVENT #1 HOUR	0	23	0	Hours		H
(H203) WEDNESDAY EVENT #1 MIN	0	59	0	Min		H
(H204) WEDNESDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H205) WEDNESDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H206) WEDNESDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H207) WEDNESDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H208) WEDNESDAY EVENT #2 HOUR	0	23	0	Hours		H
(H208) WEDNESDAY EVENT #2 HOUR	0	59	0	Min		H
(H209) WEDNESDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H210) WEDNESDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H211) WEDNESDAY EVENT #2 CHILLER SET	-50	150	40	°C/°F		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
TEMP						
(H212) WEDNESDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H213) WEDNESDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H214) WEDNESDAY EVENT #3 HOUR	0	59	0	Min		H
(H215) WEDNESDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H216) WEDNESDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H217) WEDNESDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H218) WEDNESDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H
(H219) WEDNESDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H220) WEDNESDAY EVENT #4 HOUR	0	59	0	Min		H
(H221) WEDNESDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H222) WEDNESDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H223) WEDNESDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Thursday						
(H301) THURSDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H302) THURSDAY EVENT #1 HOUR	0	23	0	Hours		H
(H303) THURSDAY EVENT #1 MIN	0	59	0	Min		H
(H304) THURSDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H305) THURSDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H306) THURSDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(H307) THURSDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H308) THURSDAY EVENT #2 HOUR	0	23	0	Hours		H
(H308) THURSDAY EVENT #2 HOUR	0	59	0	Min		H
(H309) THURSDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H310) THURSDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H311) THURSDAY EVENT #2 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H312) THURSDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H313) THURSDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H314) THURSDAY EVENT #3 HOUR	0	59	0	Min		H
(H315) THURSDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H316) THURSDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H317) THURSDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H318) THURSDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H
(H319) THURSDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H320) THURSDAY EVENT #4 HOUR	0	59	0	Min		H
(H321) THURSDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H322) THURSDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H323) THURSDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Friday						
(H401) FRIDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H402) FRIDAY EVENT #1 HOUR	0	23	0	Hours		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(H403) FRIDAY EVENT #1 MIN	0	59	0	Min		H
(H404) FRIDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H405) FRIDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H406) FRIDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H407) FRIDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H408) FRIDAY EVENT #2 HOUR	0	23	0	Hours		H
(H408) FRIDAY EVENT #2 HOUR	0	59	0	Min		H
(H409) FRIDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H410) FRIDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H411) FRIDAY EVENT #2 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H412) FRIDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H413) FRIDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H414) FRIDAY EVENT #3 HOUR	0	59	0	Min		H
(H415) FRIDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H416) FRIDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H417) FRIDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H418) FRIDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H
(H419) FRIDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H420) FRIDAY EVENT #4 HOUR	0	59	0	Min		H
(H421) FRIDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H422) FRIDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H423) FRIDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Time band parameters – Saturday						
(H501) SATURDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H502) SATURDAY EVENT #1 HOUR	0	23	0	Hours		H
(H503) SATURDAY EVENT #1 MIN	0	59	0	Min		H
(H504) SATURDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H505) SATURDAY EVENT #1 CHILLER SET TEMP	-50	50	7	°C/°F		H
(H506) SATURDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H507) SATURDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H508) SATURDAY EVENT #2 HOUR	0	23	0	Hours		H
(H508) SATURDAY EVENT #2 HOUR	0	59	0	Min		H
(H509) SATURDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H510) SATURDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H511) SATURDAY EVENT #2 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H512) SATURDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H513) SATURDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H514) SATURDAY EVENT #3 HOUR	0	59	0	Min		H
(H515) SATURDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H516) SATURDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H517) SATURDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H518) SATURDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(H519) SATURDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H520) SATURDAY EVENT #4 HOUR	0	59	0	Min		H
(H521) SATURDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H522) SATURDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H523) SATURDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Sunday						
(H601) SUNDAY EVENT #1 ENABLE	0	1	0	Flag		H
(H602) SUNDAY EVENT #1 HOUR	0	23	0	Hours		H
(H603) SUNDAY EVENT #1 MIN	0	59	0	Min		H
(H604) SUNDAY EVENT #1 MODE	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H605) SUNDAY EVENT #1 CHILLER SET TEMP	-50	500	7	°C/°F		H
(H606) SUNDAY EVENT #1 HEATPUMP SET TEMP	-50	150	40	°C/°F		H
(H607) SUNDAY EVENT #2 ENABLE	0	1	0	Flag		H
(H608) SUNDAY EVENT #2 HOUR	0	23	0	Hours		H
(H608) SUNDAY EVENT #2 HOUR	0	59	0	Min		H
(H609) SUNDAY EVENT #2 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H610) SUNDAY EVENT #2 MODE	-50	50	7	°C/°F		H
(H611) SUNDAY EVENT #2 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H612) SUNDAY EVENT #2 HEATPUMP SET TEMP	0	1	0	Flag		H
(H613) SUNDAY EVENT #3 ENABLE	0	23	0	Hours		H
(H614) SUNDAY EVENT #3 HOUR	0	59	0	Min		H
(H615) SUNDAY EVENT #3 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(H616) SUNDAY EVENT #3 MODE	-50	50	7	°C/°F		H
(H617) SUNDAY EVENT #3 CHILLER SET TEMP	-50	150	40	°C/°F		H
(H618) SUNDAY EVENT #3 HEATPUMP SET TEMP	0	1	0	Flag		H
(H619) SUNDAY EVENT #4 ENABLE	0	23	0	Hours		H
(H620) SUNDAY EVENT #4 HOUR	0	59	0	Min		H
(H621) SUNDAY EVENT #4 MIN	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(H622) SUNDAY EVENT #4 MODE	-50	50	7	°C/°F		H
(H623) SUNDAY EVENT #4 CHILLER SET TEMP	-50	150	40	°C/°F		H
Time band parameters -- Weekdays						
(Hw01) Mon-Fri Event #1 Enable	0	1	0	Flag		H
(Hw02) Mon-Fri Event #1 Hour	0	23	0	Hours		H
(Hw03) Mon-Fri Event #1 Min	0	59	0	Min		H
(Hw04) Mon-Fri Event #1 Mode	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hw05) Mon-Fri Event #1 Chiller set Temp	-50	500	7	°C/°F		H
(Hw06) Mon-Fri Event #1 HeatPump set Temp	-50	150	40	°C/°F		H
(Hw07) Mon-Fri Event #2 Enable	0	1	0	Flag		H
(Hw08) Mon-Fri Event #2 Hour	0	23	0	Hours		H
(Hw08) Mon-Fri Event #2 Hour	0	59	0	Min		H
(Hw09) Mon-Fri Event #2 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hw10) Mon-Fri Event #2 Mode	-50	50	7	°C/°F		H
(Hw11) Mon-Fri Event #2 Chiller set Temp	-50	150	40	°C/°F		H
(Hw12) Mon-Fri Event #2 HeatPump set Temp	0	1	0	Flag		H
(Hw13) Mon-Fri Event #3 Enable	0	23	0	Hours		H
(Hw14) Mon-Fri Event #3 Hour	0	59	0	Min		H
(Hw15) Mon-Fri Event #3 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT,	H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
					2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	
(Hw16) Mon-Fri Event #3 Mode	-50	50	7	°C/°F		H
(Hw17) Mon-Fri Event #3 Chiller set Temp	-50	150	40	°C/°F		H
(Hw18) Mon-Fri Event #3 HeatPump set Temp	0	1	0	Flag		H
(Hw19) Mon-Fri Event #4 Enable	0	23	0	Hours		H
(Hw20) Mon-Fri Event #4 Hour	0	59	0	Min		H
					0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hw21) Mon-Fri Event #4 Min	0	4	0	Num		
(Hw22) Mon-Fri Event #4 Mode	-50	50	7	°C/°F		H
(Hw23) Mon-Fri Event #4 Chiller set Temp	-50	150	40	°C/°F		H
Time band parameters – Monday to Friday						
(Hm01) Sat-Sun Event #1 Enable	0	1	0	Flag		H
(Hm02) Sat-Sun Event #1 Hour	0	23	0	Hours		H
(Hm03) Sat-Sun Event #1 Min	0	59	0	Min		H
					0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hm04) Sat-Sun Event #1 Mode	0	4	0	Num		
(Hm05) Sat-Sun Event #1 Chiller set Temp	-50	50	7	°C/°F		H
(Hm06) Sat-Sun Event #1 HeatPump set Temp	-50	150	40	°C/°F		H
(Hm07) Sat-Sun Event #2 Enable	0	1	0	Flag		H
(Hm08) Sat-Sun Event #2 Hour	0	23	0	Hours		H
(Hm08) Sat-Sun Event #2 Hour	0	59	0	Min		H
					0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hm09) Sat-Sun Event #2 Min	0	4	0	Num		
(Hm10) Sat-Sun Event #2 Mode	-50	50	7	°C/°F		H
(Hm11) Sat-Sun Event #2 Chiller set Temp	-50	150	40	°C/°F		H
(Hm12) Sat-Sun Event #2 HeatPump set Temp	0	1	0	Flag		H
(Hm13) Sat-Sun Event #3 Enable	0	23	0	Hours		H
(Hm14) Sat-Sun Event #3 Hour	0	59	0	Min		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Hm15) Sat-Sun Event #3 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hm16) Sat-Sun Event #3 Mode	-50	50	7	°C/°F		H
(Hm17) Sat-Sun Event #3 Chiller set Temp	-50	150	40	°C/°F		H
(Hm18) Sat-Sun Event #3 HeatPump set Temp	0	1	0	Flag		H
(Hm19) Sat-Sun Event #4 Enable	0	23	0	Hours		H
(Hm20) Sat-Sun Event #4 Hour	0	59	0	Min		H
(Hm21) Sat-Sun Event #4 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hm22) Sat-Sun Event #4 Mode	-50	50	7	°C/°F		H
(Hm23) Sat-Sun Event #4 Chiller set Temp	-50	150	40	°C/°F		H
Time band parameters – Saturday and Sunday						
(Hs01) Week Event #1 Enable	0	1	0	Flag		H
(Hs02) Week Event #1 Hour	0	23	0	Hours		H
(Hs03) Week Event #1 Min	0	59	0	Min		H
(Hs04) Week Event #1 Mode	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hs05) Week Event #1 Chiller set Temp	-50	50	7	°C/°F		H
(Hs06) Week Event #1 HeatPump set Temp	-50	150	40	°C/°F		H
(Hs07) Week Event #2 Enable	0	1	0	Flag		H
(Hs08) Week Event #2 Hour	0	23	0	Hours		H
(Hs08) Week Event #2 Hour	0	59	0	Min		H
(Hs09) Week Event #2 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hs10) Week Event #2 Mode	-50	50	7	°C/°F		H
(Hs11) Week Event #2 Chiller set Temp	-50	150	40	°C/°F		H
(Hs12) Week Event #2 HeatPump set Temp	0	1	0	Flag		H
(Hs13) Week Event #3 Enable	0	23	0	Hours		H
(Hs14) Week Event #3 Hour	0	59	0	Min		H

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Hs15) Week Event #3 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hs16) Week Event #3 Mode	-50	50	7	°C/°F		H
(Hs17) Week Event #3 Chiller set Temp	-50	150	40	°C/°F		H
(Hs18) Week Event #3 HeatPump set Temp	0	1	0	Flag		H
(Hs19) Week Event #4 Enable	0	23	0	Hours		H
(Hs20) Week Event #4 Hour	0	59	0	Min		H
(Hs21) Week Event #4 Min	0	4	0	Num	0=TB_MODE_OFF, 1=TB_MODE_HOT, 2=TB_MODE_COLD, 3=TB_MODE_MANUAL, 4=TB_MODE_LOCAL_SET	H
(Hs22) Week Event #4 Mode	-50	50	7	°C/°F		H
(Hs23) Week Event #4 Chiller set Temp	-50	150	40	°C/°F		H
Structural parameters						
(Sy01) Evaporators Number	(Sy02) <i>Evaporators Min Number</i>	(Sy03) <i>Evaporators MAX Number</i>	1	Num		C
(Sy02) Evaporators Min Number	1	4	1	Num		F
(Sy03) Evaporators MAX Number	1	4	1	Num		F
(Sy04) Circuits Number	(Sy05) <i>Circuits Min Number</i>	(Sy06) <i>Circuits MAX Number</i>	2	Num		C
(Sy05) Circuits Min Number	1	4	1	Num		F
(Sy06) Circuits MAX Number	1	4	2	Num		F
(Sy07) Compressors Number	(Sy08) <i>Compressors Min Number</i>	(Sy09) <i>Compressors MAX Number</i>	1	Num		C
(Sy08) Compressors Min Number	1	8	1	Num		F
(Sy09) Compressors MAX Number	1	8	4	Num		F
(Sy10) Pumps Number	0	2	1	Num		
(Sy11) Plant Type	0	2	2	Num	0= PLANT_CHILLER, 1=PLANT HEATPUMP, 2=PLANT_REVERSIBLE	F
(Sy12) Pump Group Enable	0	1	1	Flag		F
(Sy13) Dynamic Tset External Temperature	0	1	0	Flag		F

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Sensor						
(Sy14) Dynamic Tset Current Sensor	0	1	0	Flag		F
(Sy15) Machine Type	0	1	0	Num	0=MACHINE_WATER_AIR, 1=MACHINE_WATER_WATER	F
(Sy16) Combine Condensation	0	1	0	Flag		F
(Sy17) Number of Fans Groups	(Sy02) Evaporators Min Number	(Sy01) Evaporators Number	1	Num		F
Pump Down parameters						
(Pd01) PumpDown: Min Pressure Set point	0	50	0	Bar		C
(Pd02) PumpDown: MAX Pressure Set Point	0	50	0	Bar		C
(Pd03) PumpDown: Off-On MAX Time	0	30	6	Min		C
(Pd04) PumpDown: On-Off MAX Time	0	30	6	Min		C
(Pd05) PumpDown: Type	0	2	0	Num	0=NO_PD, 1=ON:START, 2=FULL	C
(Pd06) PumpDown: Sensor T/P	0	2	1	Num	0=PD_PRESSURE_SENSOR, 1=PD_LOW_PRESSURE_DI, 2=PD_SPECIAL_PRESSURE_DI	C
(Pd07) PumpDown: Solenoid Valve Presence	0	1	1	Flag		F
(Pd08) PumpDown: Pressure Digital Input Presence	0	1	0	Flag		F
(Pd09) PumpDown: Soft Pump Down Algorithm Enable	0	1	0	Flag		C
Regulation parameters						
(St01) Dynamic Tset: External Temp Set for Cooling	-50	150	10	°C/°F		C
(St02) Dynamic Tset: External Temp Set for Heating	-50	150	30	°C/°F		C
(St03) Dynamic Tset: Maximum Offset for Cooling	-30	30	5	°C/°F		C
(St04) Dynamic Tset: Maximum Offset for Heating	-30	30	5	°C/°F		C
(St05) Dynamic Tset: Delta Temp for Cooling	-30	30	5	°C/°F		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(St06) Dynamic Tset: Delta Temp for Heating	-30	30	5	°C/°F		C
(St07) Dynamic Tset: Thermal Regulation Type	0	2	0	Num	0=PROPORTIONAL, 1=TIME_PROPORTIONAL, 2=PI	C
(St08) Dynamic Tset: Thermal Regulation Sensor	0	2	0	Num	0=ENTRY_SENSOR, 1=EXIT_SENSOR	C
(St09) Dynamic Tset: Enable	0	2	0	Num	0=NONE, 1=TEMP_FUNCTION, 2=CURRENT_FUNCTION	C
(St10) Temp Sensor Shared for Evaporators Enable	0	1	0	Flag		F
<i>Free Cooling</i> parameters						
(Fc01) FreeCooling: Differential	0	20	3	°C/°F		C
(Fc02) FreeCooling: Hysteresis	0	20	0	°C/°F		C
(Fc03) FreeCooling: Delay between 2 Freecooling	0	500	60	Sec		C
(Fc04) FreeCooling: Sensor	0	1	0	Num		F
(Fc05) FreeCooling: Set Point Inc Time	1	30	6	Min		C
(Fc06) FreeCooling: Proportional Band	30	75	50	Num		C
(Fc07) FreeCooling: Pumps presence	0	1	0	Flag		F
(Fc08) FreeCooling: Enable	0	1	0	Flag		C
Recovery parameters						
(Hr01) Heat Recovery: Pressure Set Point	0	30	23	Bar		C
(Hr02) Heat Recovery: Pressure Hysteresis	0	15	7	Bar		C
(Hr03) Heat Recovery: Minimum Time	0	10	5	Min		C
(Hr04) Heat Recovery: Bypass Time	0	10	5	Min		C
(Hr05) Heat Recovery: Cooling Min Time	0	10	5	Min		C
(Hr06) Heat Recovery:Temp Set Point	0	20	10	°C/°F		H
(Hr07) Heat Recovery: Proportional Band	0	40	10	°C/°F		C
(Hr08) Heat Recovery: Sensor	0	1	0	Num	0=HR_CONDENSER_PRESSURE_SENSOR, 1=HR_SPECIAL_PRESSURE_DI	C
(Hr09) Heat Recovery: Flow Switch Presence	0	1	0	Flag		F
(Hr10) Heat Recovery: Pump Presence	0	1	0	Flag		F

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Hr11) Heat Recovery: Temperature Sensor Presence	0	1	0	Flag		F
(Hr12) Heat Recovery: Pressure Digital Input Presence	0	1	0	Flag		F
(Hr13) Heat Recovery: Three Way Valve Presence	0	1	0	Flag		F
(Hr14) Heat Recovery: Enable	0	1	0	Flag		
Circuit parameters						
(Cr01) Cooling High Pressure Alarm Sensor Presence	0	1	1	Flag		F
(Cr02) Cooling Low Pressure Alarm Digital Input Presence	0	1	1	Flag		F
(Cr03) Cooling Low Pressure Alarm Sensor Presence	0	1	0	Flag		F
(Cr04) Cooling High Pressure Alarm Digital Input Presence	0	1	1	Flag		F
Reversal parameters						
(Rv01) Reversing Valve Presence	0	1	1	Flag		F
Compressor parameters						
(Cp01) Compressor: Discharge Alarm Temp Set Point	40	150	125	°C/°F		C
(Cp02) Compressor: OFF-ON compressor delay	0	500	10	Sec		C
(Cp03) Compressor: ON-OFF compressor delay	0	500	10	Sec		C
(Cp04) Compressor: Swap Single Comp. On Max Time	0	300	100	Hours		C
(Cp05) Compressor: MAX Time @ Partial Power	0	300	5	Min		C
(Cp06) Compressor: Min Time @ Partial Power	0	500	3	Sec		C
(Cp07) Compressor: Oil Press Differential	0	600	30	Sec		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Alarm Entry Time						
(Cp08) Compressor: Number Of Stage	0	3	1	Num		C
(Cp09) Compressor: MAX Num Of Starts per Hour	0	20	6	Num		C
(Cp10) Compressor: Min Delay Between Two Steps (ON-OFF)	0	120	10	Sec		C
(Cp11) Compressor: Min Delay Between Two Steps (OFF-ON)	0	120	10	Sec		C
(Cp12) Compressor: Discharge Temp Differential	0	30	30	°C/°F		C
(Cp13) Compressor: Oil Press Differential Alarm Set Point	0	5	0	Bar		C
(Cp14) Compressor: Discharge Temp Alarm Sensor Type	0	2	0	Num	0=SENSOR, 1=DIGITALINPUT, 2=NO_SENSOR	F
(Cp15) Compressor: Thermal Alarm Digital Input Presence	0	1	1	Flag		F
(Cp16) Compressor: Oil Pressure Sensor Presence	0	1	0	Flag		F
(Cp17) Compressor: Starting Mode	0	2	0	Num	0=CP_IGNITION_STANDARD, 1=CP_IGNITION_PARTWINDING, 2=CP_IGNITION_STAR_TRIANGLE	C
(Cp18) Compressor: Oil Pressure Digital Input Presence	0	1	1	Flag		F
(Cp19) Compressor: Enable Compressors Swap	0	1	0	Flag		C
(Cp20) Compressor: Multistage Comp. Enable	0	1	1	Flag		C
(Cp21) Compressor: Discharge Temp Alarm Enable	0	1	1	Flag		C
(Cp22) Compressor: Differential Alarm Enable	0	1	0	Flag		C
(Cp23) Compressor: Thermal Alarm Enable	0	1	1	Flag		C
(Cp24) Compressor: Oil Pressure Digital Input Alarm Presence	0	1	1	Flag		C
(Cp25) Compressor: Liquid Injection Digital	0	1	0	Flag		F

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Output Presence						
(Cp26) Compressor: Liquid Injection Enable	0	1	0	Flag		C
(Cp27) Compressor: Liquid Injection Temperature Set Point	0	150	125	°C/°F		C
(Cp28) Compressor: Liquid Injection Hysteresis	0	100	3	°C/°F		C
Fan parameters – Fan configuration						
(Fp01) Fans: Number of Fans per Circuit	P547	P548	3	Num		C
(Fp02) Fans: Min Number of Fans per Circuit	1	8	1	Num		F
(Fp03) Fans: MAX Number of Fans per Circuit	1	8	4	Num		F
(Fp04) Fans: Fans Type	0	1	1	Num	0=CONTINUOUS, 1=DIGITAL	C
(Fp05) Fans: Different Fans Managament Enable	0	1	0	Flag		C
(Fp06) Fans: Condenser Temperature Sensor Presence	0	1	1	Flag		F
(Fp07) Fans: Temperature Digital Input Dedicated for Fans Presence	0	1	0	Flag		F
(Fp08) Fans: Single Fans Alarm Input per Condenser Presence	0	1	1	Flag		F
(Fp09) Fans: Individually Fans Stop in Case of Alarm Enable	0	1	1	Flag		C
Anti-freeze parameters						
(Af01) Antifreeze: Alarm Temp Set Point Cooling	-50	150	3	°C/°F		C
(Af02) Antifreeze: Alarm Temp Set Point Heating	-50	150	3	°C/°F		C
(Af03) Antifreeze: Temp Set Point Cooling	-50	150	5	°C/°F		C
(Af04) Antifreeze: Temp Set Point Heating	-50	150	5	°C/°F		C
(Af05) Antifreeze: Temp Hysteresis	-50	150	2	°C/°F		C
(Af06) Antifreeze: Alarm Bypass Cooling	0	1000	0	Sec		C
(Af07) Antifreeze: Alarm Bypass Heating	0	1000	300	Sec		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Af08) Antifreeze: MAX Num of Automatic Alarms	0	1000	3	Num		C
(Af09) Antifreeze: Alarm Temp Hysteresis Cooling	0	10	4	°C/°F		C
(Af10) Antifreeze: Alarm Temp Hysteresis Heating	0	10	4	°C/°F		C
(Af11) Antifreeze: Evaporator Electric Heater Presence	0	1	1	Flag		F
(Af12) Antifreeze: Alarm Enable	0	1	1	Flag		C
(Af13) Antifreeze: Electric Heater Enabled on Antifreeze Alarms	0	1	1	Flag		C
(Af14) Antifreeze: Electric Heater Enabled On Cooling	0	1	1	Flag		C
(Af15) Antifreeze: Electric Heater Enabled on Defrost	0	1	1	Flag		C
(Af16) Antifreeze: Electric Heater Enabled on Heating	0	1	1	Flag		C
(Af17) Antifreeze: Electric Heater Enabled on StdBy/Off	0	1	1	Flag		C
(Af18) Antifreeze 2: Alarm Temp Set Point Cooling	-50	150	3	°C/°F		C
(Af19) Antifreeze 2: Alarm Temp Set Point Heating	-50	150	3	°C/°F		C
(Af20) Antifreeze 2: Bypass Alarm Cooling	0	1000	0	Sec		C
(Af21) Antifreeze 2: Bypass Alarm Heating	0	1000	300	Sec		C
(Af22) Antifreeze 2: Alarm Temp Hystersis Heating	0	10	4	°C/°F		C
(Af23) Antifreeze 2: Alarm Temp Hystersis Cooling	0	10	4	°C/°F		C
(Af24) Antifreeze 2: Alarm Detection Enable	0	1	0	Flag		C
(Af25) Antifreeze 2: Max Num of Automatic	0	1000	3	Num		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Alarms						
(Af26) Antifreeze 2: Electric Heater Enable	0	1	0	Flag		F
(Af27) Antifreeze 2: Electric Heater on Alarm	0	1	0	Flag		C
<i>Defrost</i> parameters						
(Df01) Defrost: End Pressure Set Point	0	20	12	Bar		C
(Df02) Defrost: Start Temp Set Point	-30	100	12	°C/°F		C
(Df03) Defrost: End Temp Set Point	-30	100	18	°C/°F		C
(Df04) Defrost: Fans at MAX Power Press Set Point	10	30	23	Bar		C
(Df05) Defrost: Fans at MAX Power Temp Set Point	-30	100	50	°C/°F		C
(Df06) Defrost: Fans at MAX Power Press Differential	0	1000	0	Bar		C
(Df07) Defrost: Fans at MAX Power Temp Differential	0	1000	0	°C/°F		C
(Df08) Defrost: Min Delay Between two Defrosts	0	1000	1000	Min		C
(Df09) Defrost: Dripping Time	0	1000	20	Sec		C
(Df10) Defrost: OFF-ON compressor delay in Defrost	0	1000	30	Sec		C
(Df11) Defrost: Valve delay at defrost start	0	1000	30	Sec		C
(Df12) Defrost: Condenser DF Additional Temp Sensors Enable	0	1	0	Num		F
(Df13) Defrost: Condenser DF Additional Press Sensors Enable	0	1	0	Num		F
(Df14) Defrost: Cumulative time before defrost start	0	60	30	Min		C
(Df15) Defrost: Min Duration	0	60	30	Min		C
(Df16) Defrost: MAX Duration	0	30	5	Min		C
(Df17) Defrost: Low Press Alarm Bypass Time in Defrost	0	30	1	Min		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Df18) Defrost: Start Press Set Point	0	7	3	Bar		C
(Df19) Defrost: Type	0	5	2	Num	0=DF_RESISTOR, 1=DF_SOFT_INVERSION, 2=DF_FAST_INVERSION, 3=DF_FAST_INVERSION_WPD, 4=DF_E400, 5=DF_NONE	C
(Df20) Defrost: Start Sensor Type	0	1	1	Num	0=DF_ENTRY_CONDENSER_TEMPERATURE_SENSOR, 1=DF_ENTRY_CONDENSER_PRESSURE_SENSOR	C
(Df21) Defrost: End Sensor Type	0	1	0	Num	0=DF_EXIT_CONDENSER_TEMPERATURE_SENSOR, 1=DF_EXIT_CONDENSER_PRESSURE_SENSOR	C
(Df22) Defrost: Configuration	0	1	0	Num	0=SINGLE_EVAPORATOR_DEFROST, 1=COMMON_EVAPORATOR_DEFROST	C
(Df23) Defrost: Condenser Electric Heater Presence	0	1	0	Flag		F
(Df24) Defrost: Max Power During Defrost	0	1	1	Flag		C
(Df25) Defrost: Fans Max Power On Drippin'	0	1	1	Flag		C
(Df26) Defrost: Defrost Compensation Enable	0	2	0	Num		C
(Df27) Defrost: Compensation Temp Set Point	-50	150	10	°C/°F		C
(Df28) Defrost: Compensation Temp Hysteresis	-30	30	5	°C/°F		C
(Df29) Defrost: Compensation Temp Maximum Offset	-30	30	5	°C/°F		C
(Df30) Defrost: Compensation Pressure Maximum Offset	-30	30	5	°C/°F		C
Regulation algorithm parameters						
(Sp01) Soft Start Time	0	120	4	Sec		C
(Sp02) Unit Starting Mode	0	1	0	Num	0=CHILLER, 1=HEATPUMP	C
(Sp03) Evaporators' Selection Logic	0	1	0	Num	0=EV_SATURATION, 1=EV_BALANCING	C
(Sp04) Circuits' Selection Logic	0	1	0	Num	0=CR_SATURATION, 1=CR_BALANCING	C
(Sp05) Compressors' Selection Logic	0	1	0	Num	0=CP_SATURATION, 1=CP_BALANCING	C
(Sp06) Reversible Heat-Pump Enable	0	1	1	Flag		C
(Sp07) Soft Start Enable Enable	0	1	1	Flag		C
(Sp08) Machine Reversal Remote Input Presence	0	1	1	Flag		F

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Sp09) Remote OFF Input Presence	0	1	1	Flag	0=SIGNAL_OFF, 1=SIGNAL_ON	F
Special algorithm parameters						
(Ad01) Advanced Comp Selection Logic: Compressors Starts Weight	-50	50	1	Num		C
(Ad02) Advanced Comp Selection Logic: Time Weight	-50	50	1	Num		C
(Ad03) Advanced Comp Selection Logic: Enable	0	1	1	Flag		C
Diagnostic parameters – Regulation alarms						
(Dg01) Alarms: Evaporator Temp Alarm Set Point	0	15	5	°C/°F		C
(Dg02) Alarms: Evaporator Temp Alarm Alarm Bypass	5	300	120	Num		C
(Dg03) Alarms: High Inlet Temp Alarm Bypass Time	1	99	15	Min		C
(Dg04) Alarms: Low Inlet Temp Alarm Bypass Time	1	99	15	Min		C
(Dg05) Alarms: High Inlet Temp Alarm Set Point	-15	50	18	°C/°F		C
(Dg06) Alarms: Low Inlet Temp Alarm Set Point	-15	50	8	°C/°F		C
(Dg07) Alarms: Evaporator Temp Alarm Enable	0	1	0	Flag		C
(Dg08) Alarms: High Inlet Temp Alarm Enable	0	1	1	Flag		C
(Dg09) Alarms: Low Inlet Temp Alarm Enable	0	1	1	Flag		C
Electric heaters parameters						
(At01) Supplementary Heating: Evap Heater Boost Proportional Band	0	30	5	°C/°F		C
(At02) Supplementary Heating: Temp Differential to Enable Heaters	-10	10	2	°C/°F		C
(At03) Supplementary Heating: Enable	0	1	0	Flag		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Cooling Mode parameters						
(Mc01) Cooling: Set Point	(Mc02) Cooling: Min Set Point	(Mc03) Cooling: MAX Set Point	7	°C/°F		C
(Mc02) Cooling: Min Set Point	-50	50	2	°C/°F		C
(Mc03) Cooling: MAX Set Point	-50	50	20	°C/°F		C
(Mc04) Cooling: Inlet Water Temp Offset	0	15	0	°C/°F		C
(Mc05) Cooling: Proportional Band	0	20	5	°C/°F		C
(Mc06) Cooling: Min Proportional Band	-50	50	1	°C/°F		C
(Mc07) Cooling: MAX Proportional Band	-50	50	20	°C/°F		C
(Mc08) Cooling: Incremental Step Time	0	300	10	Sec		C
(Mc09) Cooling: Decremental Step Time	0	300	10	Sec		C
Heating mode parameters						
(Mh01) Heating: Set Point	(Mh02) Heating: Min Set Point	(Mh03) Heating: MAX Set Point	40	°C/°F		C
(Mh02) Heating: Min Set Point	-50	150	30	°C/°F		C
(Mh03) Heating: MAX Set Point	-50	150	50	°C/°F		C
(Mh04) Heating: Proportional Band	0	150	5	°C/°F		C
(Mh05) Heating: Min Proportional Band	0	150	1	°C/°F		C
(Mh06) Heating: MAX Proportional Band	0	150	20	°C/°F		C
(Mh07) Heating: Inc. Step Time	0	300	10	Sec		C
(Mh08) Heating: Dec. Step Time	0	300	10	Sec		C
(Mh09) Heating: Inlet Water Temp Offset	0	15	0	°C/°F		C
PI parameters						
(PI01) TREG-PI: INTEGRATIVE COSTANT	1	600	30	Sec		C
(PI02) TREG-PI: USE INTEGRATIVE COMPONENT	0	1	1	Flag		C
(PI03) TREG-PI: USE PROPORTIONAL COMPONENT	0	1	1	Flag		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Diagnostics parameters - Alarms						
(Ap01) Alarms: High Pressure Alarm Set Point	0	50	20	Bar		C
(Ap02) Alarms: Low Pressure Alarm Bypass Time	0	500	120	Sec		C
(Ap03) Alarms: Alarms Events per Hour with Auto Reset	0	20	3	Num		C
(Ap04) Alarms: High Pressure Alarm Hysteresis	0	10	1	Bar		C
(Ap05) Alarms: Low Pressure Alarm Set Point	-1	7	3	Bar		C
(Ap06) Alarms: Low Pressure Hysteresis	0	5	2	Bar		C
Fan Menu parameters – Fan control						
(Ff01) Fans: Control Type	0	2	1	Num	0=FANS_CONTINOUS, 1=FANS_DIGITAL, 2=FANS_MAXPOWER	C
(Ff02) Fans: Control Sensor (T/P)	0	2	0	Num	0=CONDENSER_PRESSURE_SENSOR, 1=CONDENSER_PRESSURE_DI, 2=CONDENSER_TEMPERATURE_SENSOR, 3=CONDENSER_TEMPERATURE_DI	C
(Ff03) Fans: OFF if Compressors OFF	0	1	1	Num		C
(Ff04) Fans: Max Power if Condenser Sensor is Faulty	0	1	1	Num		C
Fan Menu parameters – Fan set						
(Fm01) Fans: Cut-off Temperature Set Point	0	50	12	°C/°F		C
(Fm02) Fans: Cut-off Temperature Hysteresis	0	50	1	°C/°F		C
(Fm03) Fans: Cut-off Pressure Set Point	0	35	5	Bar		C
(Fm04) Fans: Cut-off:Temperature Set Point	0	50	12	°C/°F		C
(Fm05) Fans: Cut-off Temperature Hysteresis	0	50	1	°C/°F		C
(Fm06) Fans: Cut-off Pressure Set Point	0	35	5	Bar		C
(Fm07) Fans: Temp Set Point for Min Fan Speed Cooling	0	50	13	°C/°F		C
(Fm08) Fans: Temp Set Point for MAX Fan Speed Cooling	0	50	19	°C/°F		C
(Fm09) Fans: Press Set Point for Min Fan	0	25	10	Bar		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Speed Cooling						
(Fm10) Fans: Press Set Point for MAX Fan Speed Cooling	0	25	20	Bar		C
(Fm11) Fans: Temp Set Point for Min Fan Speed Heating	0	50	13	°C/°F		C
(Fm12) Fans: Temp Set Point for MAX Fan Speed Heating	0	50	19	°C/°F		C
(Fm13) Fans: Press Set Point for Min Fan Speed Heating	0	25	10	Bar		C
(Fm14) Fans: Press Set Point for MAX Fan Speed Heating	0	25	20	Bar		C
(Fm15) Fans: Cut-off Bypass Time Heating	0	120	30	Sec		C
(Fm16) Fans: Cut-off Bypass Time Cooling	0	120	30	Sec		C
(Fm17) Fans: Pickup Time Cooling	0	120	60	Sec		C
(Fm18) Fans: Min Speed Cooling	0	100	40	Num		C
(Fm19) Fans: MAX Speed Cooling	0	100	40	Num		C
(Fm20) Fans: Pickup Time Heating	0	120	60	Sec		C
(Fm21) Fans: Min Speed Heating	0	100	40	Num		C
(Fm22) Fans: MAX Speed Heating	0	100	40	Num		C
(Fm23) Fans: Cut-off Pressure Hysteresis Cooling	0	5	1	Bar		C
(Fm24) Fans: Cut-off Pressure Hysteresis Heating	0	5	1	Bar		C
(Fm25) Fans: Cut-off Enable Cooling	0	1	0	Num		C
(Fm26) Fans: Cut-off Enable Heating	0	1	0	Num		C
Fan Menu parameters – Cooling fan step						
(Fr01) Fans Step Cooling: Pressure Set Point Step 2	0	30	12	Bar		C
(Fr02) Fans Step Cooling: Temperature Set Point Step 2	0	150	0	°C/°F		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Fr03) Fans Step Cooling: Pressure Set Point Step 3	0	30	14	Bar		C
(Fr04) Fans Step Cooling: Temperature Set Point Step 3	0	150	0	°C/°F		C
(Fr05) Fans Step Cooling: Pressure Set Point Step 4	0	30	16	Bar		C
(Fr06) Fans Step Cooling: Temperature Set Point Step 4	0	150	0	°C/°F		C
(Fr07) Fans Step Cooling: Pressure Set Point Step 1	0	30	10	Bar		C
(Fr08) Fans Step Cooling: Temperature Set Point Step 1	0	150	0	°C/°F		C
(Fr09) Fans Step Cooling: Pressure Set Point Step 5	0	30	0	Bar		C
(Fr10) Fans Step Cooling: Temperature Set Point Step 5	0	150	0	°C/°F		C
(Fr11) Fans Step Cooling: Pressure Set Point Step 6	0	30	0	Bar		C
(Fr12) Fans Step Cooling: Temperature Set Point Step 6	0	150	0	°C/°F		C
(Fr13) Fans Step Cooling: Pressure Set Point Step 7	0	30	0	Bar		C
(Fr14) Fans Step Cooling: Temperature Set Point Step 7	0	150	0	°C/°F		C
(Fr15) Fans Step Cooling: Pressure Set Point Step 8	0	30	0	Bar		C
(Fr16) Fans Step Cooling: Temperature Set Point Step 8	0	150	0	°C/°F		C
(Fr17) Fans Step Cooling: Temp Hysteris Step 1	0	30	0	°C/°F		C
(Fr18) Fans Step Cooling: Temp Hysteris Step	0	30	0	°C/°F		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
2						
(Fr19) Fans Step Cooling: Temp Hysteris Step 3	0	30	0	°C/°F		C
(Fr20) Fans Step Cooling: Temp Hysteris Step 4	0	30	0	°C/°F		C
(Fr21) Fans Step Cooling: Temp Hysteris Step 5	0	30	0	°C/°F		C
(Fr22) Fans Step Cooling: Temp Hysteris Step 6	0	30	0	°C/°F		C
(Fr23) Fans Step Cooling: Temp Hysteris Step 7	0	30	0	°C/°F		C
(Fr24) Fans Step Cooling: Temp Hysteris Step 8	0	30	0	°C/°F		C
(Fr25) Fans Step Cooling: Pressure Hysteris Step 1	0	10	2	Bar		C
(Fr26) Fans Step Cooling: Pressure Hysteris Step 2	0	10	2	Bar		C
(Fr27) Fans Step Cooling: Pressure Hysteris Step 3	0	10	2	Bar		C
(Fr28) Fans Step Cooling: Pressure Hysteris Step 4	0	10	2	Bar		C
(Fr29) Fans Step Cooling: Pressure Hysteris Step 5	0	10	0	Bar		C
(Fr30) Fans Step Cooling: Pressure Hysteris Step 6	0	10	0	Bar		C
(Fr31) Fans Step Cooling: Pressure Hysteris Step 7	0	10	0	Bar		C
(Fr32) Fans Step Cooling: Pressure Hysteris Step 8	0	10	0	Bar		C
Fan <i>Menu</i> parameters – <i>Heating</i> fan step						
(Fh01) Fans Step Heating: Pressure Set Point	0	60	8	Bar		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Step 1						
(Fh02) Fans Step Heating: Temperature Set Point Step 1	0	150	0	°C/°F		C
(Fh03) Fans Step Heating: Pressure Set Point Step 2	0	60	6	Bar		C
(Fh04) Fans Step Heating: Temperature Set Point Step 2	0	150	0	°C/°F		C
(Fh05) Fans Step Heating: Pressure Set Point Step 3	0	60	4	Bar		C
(Fh06) Fans Step Heating: Temperature Set Point Step 3	0	150	0	°C/°F		C
(Fh07) Fans Step Heating: Pressure Set Point Step 4	0	60	2	Bar		C
(Fh08) Fans Step Heating: Temperature Set Point Step 4	0	150	0	°C/°F		C
(Fh09) Fans Step Heating: Pressure Set Point Step 5	0	60	0	Bar		C
(Fh10) Fans Step Heating: Temperature Set Point Step 5	0	150	0	°C/°F		C
(Fh11) Fans Step Heating: Pressure Set Point Step 6	0	60	0	Bar		C
(Fh12) Fans Step Heating: Temperature Set Point Step 6	0	150	0	°C/°F		C
(Fh13) Fans Step Heating: Pressure Set Point Step 7	0	60	0	Bar		C
(Fh14) Fans Step Heating: Temperature Set Point Step 7	0	150	0	°C/°F		C
(Fh15) Fans Step Heating: Pressure Set Point Step 8	0	60	0	Bar		C
(Fh16) Fans Step Heating: Temperature Set Point Step 8	0	150	0	°C/°F		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
(Fh17) Fans Step Heating: Temp Hysteris Step 1	0	30	0	°C/°F		C
(Fh18) Fans Step Heating: Temp Hysteris Step 2	0	30	0	°C/°F		C
(Fh19) Fans Step Heating: Temp Hysteris Step 3	0	30	0	°C/°F		C
(Fh20) Fans Step Heating: Temp Hysteris Step 4	0	30	0	°C/°F		C
(Fh21) Fans Step Heating: Temp Hysteris Step 5	0	30	0	°C/°F		C
(Fh22) Fans Step Heating: Temp Hysteris Step 6	0	30	0	°C/°F		C
(Fh23) Fans Step Heating: Temp Hysteris Step 7	0	30	0	°C/°F		C
(Fh24) Fans Step Heating: Temp Hysteris Step 8	0	30	0	°C/°F		C
(Fh25) Fans Step Heating: Pressure Hysteris Step 1	0	10	2	Bar		C
(Fh26) Fans Step Heating: Pressure Hysteris Step 2	0	10	2	Bar		C
(Fh27) Fans Step Heating: Pressure Hysteris Step 3	0	10	2	Bar		C
(Fh28) Fans Step Heating: Pressure Hysteris Step 4	0	10	2	Bar		C
(Fh29) Fans Step Heating: Pressure Hysteris Step 5	0	10	0	Bar		C
(Fh30) Fans Step Heating: Pressure Hysteris Step 6	0	10	0	Bar		C
(Fh31) Fans Step Heating: Pressure Hysteris Step 7	0	10	0	Bar		C
(Fh32) Fans Step Heating: Pressure Hysteris	0	10	0	Bar		C

Keyboard strings	Min limit	Max limit	Default	M.U.	Remarks	Type
Step 8						
Pump parameters						
(Pp01) Pumpgroup: Comp Stop Delay on Pump Rotation	0	1000	15	Sec		C
(Pp02) Pumpgroup: Pump ON - compressors ON delay	0	2000	60	Sec		C
(Pp03) Pumpgroup: Compressor OFF - pump OFF delay	0	2000	60	Sec		C
(Pp04) Pumpgroup: Pump ON - compressors ON delay (on demand)	0	1000	13	Sec		C
(Pp05) Pumpgroup: Compressor OFF - pump OFF delay (on demand)	0	1000	12	Sec		C
(Pp06) Pumpgroup: Flow Switch Alarm Auto->Man Time	1	60	10	Sec		C
(Pp07) Pumpgroup: Flow Switch Alarm Bypass Startup Time	1	99	15	Sec		C
(Pp08) Pumpgroup: Flow Switch Alarm Entry Time	0	60	10	Sec		C
(Pp09) Pumpgroup: Flow Switch Alarm Exit Time	0	60	10	Sec		C
(Pp10) Pumpgroup: Pump Rotation Time	1	99	12	Hours		C
(Pp11) Pumpgroup: Control Type	0	2	2	Num	0=INDEPENDENT, 1=PUMPGROUP, 2=INDIVIDUAL	C
(Pp12) Pumpgroup: Comp Stop on Pump Rotation Enable	0	1	1	Num		C
((Pp13) Pumpgroup: Pump On Demand Enable) Pumpgroup: Pump On Demand Enable	0	1	0	Num		C

12 USE OF THE DEVICE

12.1 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

12.2 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.

13 RESPONSIBILITY AND RESIDUAL RISKS

Eliwell & Controlli 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.

14 DISCLAIMER

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15 GLOSSARY

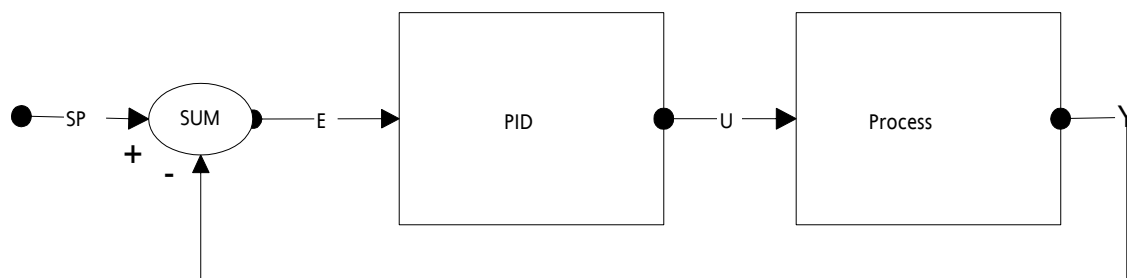
Logical OR	Several inputs that are linked in an OR relation are equivalent to a single input with the following status: <ul style="list-style-type: none"> • Active if at least one input is active • Inactive if no input is active
Scroll up	Scrolling up a <i>menu</i> means viewing all the parameters from the bottom to the top (10 -> 09 -> 08)
Standby	Means that the unit is in waiting mode and that all the <i>functions</i> are temporarily interrupted.
Reset	Means to restore to zero.
Resetting	<i>Resetting</i> an alarm means correcting the error condition and re-activating the alarm so that it can emit new signals.
Manual reset	A manually resettable alarm can only be <i>reset</i> using the keyboard.
Scroll down	Scrolling ?down a <i>menu</i> means viewing all the parameters from top to bottom (08 -> 09 -> 10).
BLINK	Means flashing. This term generally refers to LEDs.
Average hours	The average is calculated as the ratio between the total hours of <i>compressors</i> available and the number of <i>compressors</i> on the circuit.
Loads	These identify the various devices in a plant such as <i>compressors</i> , fans, hydraulic pump and <i>anti-freeze electric heaters</i> .
Set Point	This represents the reference value (that can be set by the user) that defines the operating status of the system. A typical example is the thermostat that regulates the temperature in our homes: to maintain a temperature of 20 °C, we must set a <i>set point</i> of 20°C (the <i>heating</i> system will start if the ambient temperature measured is below 20°C and will be turned off otherwise).
Range	This represents a set of values; i.e. <i>Range</i> 1...100 includes all the values between 1 and 100.
Hysteresis	<i>Hysteresis</i> is generally defined in connection with a <i>set point</i> to avoid frequent oscillations in the status of the controlled load. Example: let's define a <i>set point</i> of 20°C on a probe that detects ambient temperature so that the compressor starts every time the limit value is exceeded. When ambient temperature reaches values that are close to the <i>set point</i> (20°C), a phase of instability occurs during which the relay, which starts the compressor, frequently changes its status from ON to OFF. This condition can severely damage system operating. To avoid this problem, <i>hysteresis</i> is defined as a tolerance <i>range</i> in which no status change occurs; in our specific case, if <i>hysteresis</i> of 1°C is set, the compressor starts at 21°C (<i>set point</i> + <i>hysteresis</i>) and stops at 19°C (<i>set point</i> - <i>hysteresis</i>).
Non volatile memory	This memory stores the data even when the unit is turned off (as opposed to a volatile memory that deletes the data as soon as the unit is turned off).
Cut-off	It represents the temperature/pressure below/above which the proportional output is disabled.
PID	A continuous <i>PID</i> regulator and the related digital version, resulting from the DISCRETE CONVERSION of its transfer function, generates a control signal that is equivalent to the sum of the following three items: <ul style="list-style-type: none"> • P proportional to error • I proportional to error integration component • D proportional to error proportional derivative

The base *PID* controller offers an ideal transfer function between:

Input $e(t) = SP(t) - VP(t)$, i.e. the system error, equivalent to the difference between a reference signal (*set point*) and the measured process variable.

And the control signal $u(t)$, applied to the actuator or directly to the process for control purposes.

For further information, see the following block diagram, where the process output Y is the process variable that is fed back:



In the frequency domain the controller can be described by the following transfer function:

$$\frac{U(s)}{E(s)} = K_p + \frac{K_i}{s} + sK_d = K_p \left[1 + \frac{1}{sT_i} + sT_d \right],$$

Where K_p, K_i, K_d are the gains of the proportional, integrative and derivative action.

And $T_i = \frac{K_p}{K_i}$, $T_d = \frac{K_d}{K_p}$ are the times of the integrative and derivative action.

Over time, the input/output relation is:

$$u(t) = K_p e(t) + K_i \int e(t) + K_d \frac{de(t)}{dt}.$$

When the process variable reaches the [set point](#), i.e. when the error input to the regulator gets closer to zero:

The proportional action generates an almost null output, because it is proportional to an almost null error of the input.

Even the derivative action generates an almost null output, which is proportional to the input variation speed, which is null close to value zero.

The integrative action generates instead an input error over time, which starts when the control and the controlled system reach the fixed [set point](#).

It is this last part of the regulator output that causes an excess in the controller output and an excessive increase of the duration of the process variable applied as feedback instead of the [set point](#).

If the error continues to be integrated in time and consequently the output of the regulator continues to increase, the amplifier that processes the integrative action saturates. The error must change sign for a specific interval of time for the output of the integrative component to become linear once again.

The above-described phenomenon is called [saturation](#) of the integral action (wind up [reset](#)).

The filter used to prevent the excessive increase of the duration of the measured process variable is: the wind up anti [reset \(ARW\)](#).

ARW The [ARW](#) filter prevents the [saturation](#) of the integrative action by blocking the integrative action when the input error is above a specified value (the process variable exceed the band around the [set point](#)).

The [ARW](#) filter produces on the integration action an ON/OFF operation if the amplitude of the process variable variation is above or below the predefined limit as compared to the [set point](#).

The output of the integrative action is therefore maintained within the limits of the [saturation](#) block and the error integration is blocked.

In this controller, errors are added if the integrative error has a different sign as compared to the instantaneous error; if the signs are the same, errors are added only if the units is off or saturated (active steps equivalent to zero or to the maximum value).

(
(H008) MONDAY EVENT #2 MIN) MONDAY EVENT #2 HOUR.....	116
((Pp13) Pumpgroup: Pump On Demand Enable)	
Pumpgroup: Pump On Demand Enable.....	144
(Ad01) Advanced Comp Selection Logic:	
Compressors Starts Weight	136
(Ad02) Advanced Comp Selection Logic: Time Weight.....	136
(Ad03) Advanced Comp Selection Logic: Enable..	136
(Af01) Antifreeze: Alarm Temp Set Point Cooling	132
(Af02) Antifreeze: Alarm Temp Set Point Heating	132
(Af03) Antifreeze: Temp Set Point Cooling.....	132
(Af04) Antifreeze: Temp Set Point Heating	132
(Af05) Antifreeze: Temp Hysteresis.....	132
(Af06) Antifreeze: Alarm Bypass Cooling	133
(Af07) Antifreeze: Alarm Bypass Heating	133
(Af08) Antifreeze: MAX Num of Automatic Alarms	133
(Af09) Antifreeze: Alarm Temp Hysteresis Cooling	133
(Af10) Antifreeze: Alarm Temp Hysteresis Heating	133
(Af11) Antifreeze: Evaporator Electric Heater Presence	133
(Af12) Antifreeze: Alarm Enable	133
(Af13) Antifreeze: Electric Heater Enabled on Antifreeze Alarms	133
(Af14) Antifreeze: Electric Heater Enabled On Cooling.....	133
(Af15) Antifreeze: Electric Heater Enabled on Defrost	133
(Af16) Antifreeze: Electric Heater Enabled on Heating	133
(Af17) Antifreeze: Electric Heater Enabled on StdBy/Off	133
(Af18) Antifreeze 2: Alarm Temp Set Point Cooling	133
(Af19) Antifreeze 2: Alarm Temp Set Point Heating	133
(Af20) Antifreeze 2: Bypass Alarm Cooling	133
(Af21) Antifreeze 2: Bypass Alarm Heating.....	133
(Af22) Antifreeze 2: Alarm Temp Hystersis Heating	133
(Af23) Antifreeze 2: Alarm Temp Hystersis Cooling	133
(Af24) Antifreeze 2: Alarm Detection Enable.....	134
(Af25) Antifreeze 2: Max Num of Automatic Alarms	134
(Af26) Antifreeze 2: Electric Heater Enable	134
(Af27) Antifreeze 2: Electric Heater on Alarm	134
(Ap01) Alarms: High Pressure Alarm Set Point	138
(Ap02) Alarms: Low Pressure Alarm Bypass Time	138
(Ap03) Alarms: Alarms Events per Hour with Auto Reset.....	138
(Ap04) Alarms: High Pressure Alarm Hysteresis...	138
(Ap05) Alarms: Low Pressure Alarm Set Point.....	138
(Ap06) Alarms: Low Pressure Hysteresis	138
(At01) Supplementary Heating: Evap Heater Boost Proportional Band	136
(At02) Supplementary Heating: Temp Differential to Enable Heaters.....	136
(At03) Supplementary Heating: Enable	137
(Bc01) Main Board (MB) Type.....	108
(Bc02) Main Board (MB) Enabling	108
(Bc03) Main Board (MB) UM.....	108
(Bc04) (MB) Probes AI1...AI4 Type.....	108
(Bc05) (MB) Probes AI5 AI6 Type.....	109
(Bc06) (MB) Probes AI7 AI8 Type.....	109
(Bc07) (MB) Offset Probe AI1	109
(Bc08) (MB) Offset Probe AI2	109
(Bc09) (MB) Offset Probe AI3	109
(Bc10) (MB) Offset Probe AI4	109
(Bc11) (MB) Offset Probe AI5	109
(Bc12) (MB) Offset Probe AI6	109
(Bc13) (MB) Offset Probe AI7	109
(Bc14) (MB) Offset Probe AI8	109
(Bc15) (MB) Pressure Value 4mA Probe AI5	109
(Bc16) (MB) Pressure Value 20mA Probe AI5	109
(Bc17) (MB) Pressure Value 4mA Probe AI6	109
(Bc18) (MB) Pressure Value 20mA Probe AI6	109
(Bc19) (MB) Pressure Value 4mA Probe AI7	109
(Bc20) (MB) Pressure Value 20mA Probe AI7	109
(Bc21) (MB) Pressure Value 4mA Probe AI8	109
(Bc22) (MB) Pressure Value 20mA Probe AI8	109
(Cg01) Main Board digital Inputs Low Voltage ...	108
(Cg02) Main Board digital Inputs High Voltage..	108
(Cg03) Main Board digital Inputs Mixed High/Low	108
(Cg04) Language.....	108
(Cg05) RTC Enable	108
(Cg06) On Off Remote Enable	108
(Cg07) Machine Reversal Remote Enable.....	108
(Cg08) Events Enable	108
(Cg09) Events Type.....	108
(Cg10) Menu Timeout	108
(Cg11) Plant Mode Manual.....	108
(Cg12) Config Password.....	108
(Cg13) Partialization Mode.....	108
(Cg14) Dynamic I/O Allocation	108
(Cg15) User ID (1st Part).....	108
(Cg16) User ID (2nd Part)	108

(Cg17) BLACK BOX Enable.....	108
(Cg18) BLACK BOX Delay.....	108
(Cg19) BLACK BOX Time Between Samples.....	108
(Cg20) Delta Start T1.....	108
(Cg21) Delta Start T2.....	108
(Cm01) FAA Address.....	114
(Cm02) VIS MOD.....	115
(Cm03) PCH.....	115
(Cm04) CRC.....	115
(Cm09) Modem Enable.....	115
(Cm10) Init String (1st part).....	115
(Cm11) Init String (2nd part).....	115
(Cm12) HangUp String.....	115
(Cm13) Phone Number (to dial).....	115
(Cm14) BLACK BOX Memory Full Call Enable Enable.....	115
(Cm15) Manual Alarms Call Enable.....	115
(Cm16) Automatic Alarms Call Enable.....	115
(Cm17) Bounded Alarms Call Enable.....	115
(Cm18) System Alarms Call Enable.....	115
(Cm19) Daily Call Enable.....	115
(Cm20) Number or Retries.....	115
(Cm21) Delay on Retry.....	115
(Cm22) Daily Call Time (Hour).....	115
(Cm23) Daily Call Time (Min).....	115
(Cm24) COM1 Protocol Type.....	115
(Cm25) COM1 Baud Rate.....	115
(Cm26) COM1 Parity.....	115
(Cm27) COM2 Protocol Type.....	115
(Cm28) COM2 Baud Rate.....	115
(Cm29) COM2 Parity.....	116
(Cm30) COM2 Data Length.....	116
(Cm31) COM2 RTS Handling Enable.....	116
(Cp01) Compressor: Discharge Alarm Temp Set Point.....	130
(Cp02) Compressor: OFF-ON compressor delay ...	130
(Cp03) Compressor: ON-OFF compressor delay ...	130
(Cp04) Compressor: Swap Single Comp. On Max Time.....	130
(Cp05) Compressor: MAX Time @ Partial Power..	130
(Cp06) Compressor: Min Time @ Partial Power....	131
(Cp07) Compressor: Oil Press Differential Alarm Entry Time.....	131
(Cp08) Compressor: Number Of Stage.....	131
(Cp09) Compressor: MAX Num Of Starts per Hour.....	131
(Cp10) Compressor: Min Delay Between Two Steps (ON-OFF).....	131
(Cp11) Compressor: Min Delay Between Two Steps (OFF-ON).....	131
(Cp12) Compressor: Discharge Temp Differential	131
(Cp13) Compressor: Oil Press Differential Alarm Set Point.....	131
(Cp14) Compressor: Discharge Temp Alarm Sensor Type.....	131
(Cp15) Compressor: Thermal Alarm Digital Input Presence.....	131
(Cp16) Compressor: Oil Pressure Sensor Presence	131
(Cp17) Compressor: Starting Mode.....	131
(Cp18) Compressor: Oil Pressure Digital Input Presence.....	131
(Cp19) Compressor: Enable Compressors Swap ...	131
(Cp20) Compressor: Multistage Comp. Enable	131
(Cp21) Compressor: Discharge Temp Alarm Enable.....	131
(Cp22) Compressor: Differential Alarm Enable	131
(Cp23) Compressor: Thermal Alarm Enable.....	131
(Cp24) Compressor: Oil Pressure Digital Input Alarm Presence.....	131
(Cp25) Compressor: Liquid Injection Digital Output Presence.....	132
(Cp26) Compressor: Liquid Injection Enable	132
(Cp27) Compressor: Liquid Injection Temperature Set Point.....	132
(Cp28) Compressor: Liquid Injection Hysteresis....	132
(Cr01) Cooling High Pressure Alarm Sensor Presence.....	130
(Cr02) Cooling Low Pressure Alarm Digital Input Presence.....	130
(Cr03) Cooling Low Pressure Alarm Sensor Presence.....	130
(Cr04) Cooling High Pressure Alarm Digital Input Presence.....	130
(Df01) Defrost: End Pressure Set Point.....	134
(Df02) Defrost: Start Temp Set Point.....	134
(Df03) Defrost: End Temp Set Point.....	134
(Df04) Defrost: Fans at MAX Power Press Set Point.....	134
(Df05) Defrost: Fans at MAX Power Temp Set Point.....	134
(Df06) Defrost: Fans at MAX Power Press Differential.....	134
(Df07) Defrost: Fans at MAX Power Temp Differential.....	134
(Df08) Defrost: Min Delay Between two Defrosts.	134
(Df09) Defrost: Dripping Time.....	134
(Df10) Defrost: OFF-ON compressor delay in Defrost.....	134
(Df11) Defrost: Valve delay at defrost start.....	134
(Df12) Defrost: Condenser DF Additional Temp Sensors Enable.....	134
(Df13) Defrost: Condenser DF Additional Press Sensors Enable.....	134
(Df14) Defrost: Cumulative time before defrost start.....	134
(Df15) Defrost: Min Duration.....	134

(Df16) Defrost: MAX Duration	134	(Fh05) Fans Step Heating: Pressure Set Point Step 3	142
(Df17) Defrost: Low Press Alarm Bypass Time in Defrost	135	(Fh06) Fans Step Heating: Temperature Set Point Step 3	142
(Df18) Defrost: Start Press Set Point	135	(Fh07) Fans Step Heating: Pressure Set Point Step 4	142
(Df19) Defrost: Type	135	(Fh08) Fans Step Heating: Temperature Set Point Step 4	142
(Df20) Defrost: Start Sensor Type	135	(Fh09) Fans Step Heating: Pressure Set Point Step 5	142
(Df21) Defrost: End Sensor Type	135	(Fh10) Fans Step Heating: Temperature Set Point Step 5	142
(Df22) Defrost: Configuration	135	(Fh11) Fans Step Heating: Pressure Set Point Step 6	142
(Df23) Defrost: Condenser Electric Heater Presence	135	(Fh12) Fans Step Heating: Temperature Set Point Step 6	142
(Df24) Defrost: Max Power During Defrost	135	(Fh13) Fans Step Heating: Pressure Set Point Step 7	142
(Df25) Defrost: Fans Max Power On Drippin'	135	(Fh14) Fans Step Heating: Temperature Set Point Step 7	142
(Df26) Defrost: Defrost Compensation Enable	135	(Fh15) Fans Step Heating: Pressure Set Point Step 8	142
(Df27) Defrost: Compensation Temp Set Point	135	(Fh16) Fans Step Heating: Temperature Set Point Step 8	143
(Df28) Defrost: Compensation Temp Hysteresis	135	(Fh17) Fans Step Heating: Temp Hysteris Step 1 ..	143
(Df29) Defrost: Compensation Temp Maximum Offset	135	(Fh18) Fans Step Heating: Temp Hysteris Step 2 ..	143
(Df30) Defrost: Compensation Pressure Maximum Offset	135	(Fh19) Fans Step Heating: Temp Hysteris Step 3 ..	143
(Dg01) Alarms: Evaporator Temp Alarm Set Point	136	(Fh20) Fans Step Heating: Temp Hysteris Step 4 ..	143
(Dg02) Alarms: Evaporator Temp Alarm Alarm Bypass	136	(Fh21) Fans Step Heating: Temp Hysteris Step 5 ..	143
(Dg03) Alarms: High Inlet Temp Alarm Bypass Time	136	(Fh22) Fans Step Heating: Temp Hysteris Step 6 ..	143
(Dg04) Alarms: Low Inlet Temp Alarm Bypass Time	136	(Fh23) Fans Step Heating: Temp Hysteris Step 7 ..	143
(Dg05) Alarms: High Inlet Temp Alarm Set Point	136	(Fh24) Fans Step Heating: Temp Hysteris Step 8 ..	143
(Dg06) Alarms: Low Inlet Temp Alarm Set Point	136	(Fh25) Fans Step Heating: Pressure Hysteris Step 1	143
(Dg07) Alarms: Evaporator Temp Alarm Enable	136	(Fh26) Fans Step Heating: Pressure Hysteris Step 2	143
(Dg08) Alarms: High Inlet Temp Alarm Enable	136	(Fh27) Fans Step Heating: Pressure Hysteris Step 3	143
(Dg09) Alarms: Low Inlet Temp Alarm Enable	136	(Fh28) Fans Step Heating: Pressure Hysteris Step 4	143
(Fc01) FreeCooling: Differential	129	(Fh29) Fans Step Heating: Pressure Hysteris Step 5	143
(Fc02) FreeCooling: Hysteresis	129	(Fh30) Fans Step Heating: Pressure Hysteris Step 6	143
(Fc03) FreeCooling: Delay between 2 Freecooling	129	(Fh31) Fans Step Heating: Pressure Hysteris Step 7	143
(Fc04) FreeCooling: Sensor	129	(Fh32) Fans Step Heating: Pressure Hysteris Step 8	144
(Fc05) FreeCooling: Set Point Inc Time	129	(Fm01) Fans: Cut-off Temperature Set Point	138
(Fc06) FreeCooling: Proportional Band	129	(Fm02) Fans: Cut-off Temperature Hysteresis	138
(Fc07) FreeCooling: Pumps presence	129	(Fm03) Fans: Cut-off Pressure Set Point	138
(Fc08) FreeCooling: Enable	129	(Fm04) Fans: Cut-off:Temperature Set Point	138
(Ff01) Fans: Control Type	138	(Fm05) Fans: Cut-off Temperature Hysteresis	138
(Ff02) Fans: Control Sensor (T/P)	138		
(Ff03) Fans: OFF if Compressors OFF	138		
(Ff04) Fans: Max Power if Condenser Sensor is Faulty	138		
(Fh01) Fans Step Heating: Pressure Set Point Step 1	142		
(Fh02) Fans Step Heating: Temperature Set Point Step 1	142		
(Fh03) Fans Step Heating: Pressure Set Point Step 2	142		
(Fh04) Fans Step Heating: Temperature Set Point Step 2	142		

(Fm06) Fans: Cut-off Pressure Set Point	138
(Fm07) Fans: Temp Set Point for Min Fan Speed Cooling	138
(Fm08) Fans: Temp Set Point for MAX Fan Speed Cooling	138
(Fm09) Fans: Press Set Point for Min Fan Speed Cooling	139
(Fm10) Fans: Press Set Point for MAX Fan Speed Cooling	139
(Fm11) Fans: Temp Set Point for Min Fan Speed Heating	139
(Fm12) Fans: Temp Set Point for MAX Fan Speed Heating	139
(Fm13) Fans: Press Set Point for Min Fan Speed Heating	139
(Fm14) Fans: Press Set Point for MAX Fan Speed Heating	139
(Fm15) Fans: Cut-off Bypass Time Heating	139
(Fm16) Fans: Cut-off Bypass Time Cooling	139
(Fm17) Fans: Pickup Time Cooling	139
(Fm18) Fans: Min Speed Cooling	139
(Fm19) Fans: MAX Speed Cooling	139
(Fm20) Fans: Pickup Time Heating	139
(Fm21) Fans: Min Speed Heating	139
(Fm22) Fans: MAX Speed Heating	139
(Fm23) Fans: Cut-off Pressure Hysteresis Cooling	139
(Fm24) Fans: Cut-off Pressure Hysteresis Heating	139
(Fm25) Fans: Cut-off Enable Cooling	139
(Fm26) Fans: Cut-off Enable Heating	139
(Fp01) Fans: Number of Fans per Circuit	132
(Fp02) Fans: Min Number of Fans per Circuit	132
(Fp03) Fans: MAX Number of Fans per Circuit	132
(Fp04) Fans: Fans Type	132
(Fp05) Fans: Different Fans Managment Enable	132
(Fp06) Fans: Condenser Temperature Sensor Presence	132
(Fp07) Fans: Temperature Digital Input Dedicated for Fans Presence	132
(Fp08) Fans: Single Fans Alarm Input per Condenser Presence	132
(Fp09) Fans: Individually Fans Stop in Case of Alarm Enable	132
(Fr01) Fans Step Cooling: Pressure Set Point Step 2	139
(Fr02) Fans Step Cooling: Temperature Set Point Step 2	140
(Fr03) Fans Step Cooling: Pressure Set Point Step 3	140
(Fr04) Fans Step Cooling: Temperature Set Point Step 3	140
(Fr05) Fans Step Cooling: Pressure Set Point Step 4	140

(Fr06) Fans Step Cooling: Temperature Set Point Step 4	140
(Fr07) Fans Step Cooling: Pressure Set Point Step 1	140
(Fr08) Fans Step Cooling: Temperature Set Point Step 1	140
(Fr09) Fans Step Cooling: Pressure Set Point Step 5	140
(Fr10) Fans Step Cooling: Temperature Set Point Step 5	140
(Fr11) Fans Step Cooling: Pressure Set Point Step 6	140
(Fr12) Fans Step Cooling: Temperature Set Point Step 6	140
(Fr13) Fans Step Cooling: Pressure Set Point Step 7	140
(Fr14) Fans Step Cooling: Temperature Set Point Step 7	140
(Fr15) Fans Step Cooling: Pressure Set Point Step 8	140
(Fr16) Fans Step Cooling: Temperature Set Point Step 8	140
(Fr17) Fans Step Cooling: Temp Hysteris Step 1	140
(Fr18) Fans Step Cooling: Temp Hysteris Step 2	141
(Fr19) Fans Step Cooling: Temp Hysteris Step 3	141
(Fr20) Fans Step Cooling: Temp Hysteris Step 4	141
(Fr21) Fans Step Cooling: Temp Hysteris Step 5	141
(Fr22) Fans Step Cooling: Temp Hysteris Step 6	141
(Fr23) Fans Step Cooling: Temp Hysteris Step 7	141
(Fr24) Fans Step Cooling: Temp Hysteris Step 8	141
(Fr25) Fans Step Cooling: Pressure Hysteris Step 1	141
(Fr26) Fans Step Cooling: Pressure Hysteris Step 2	141
(Fr27) Fans Step Cooling: Pressure Hysteris Step 3	141
(Fr28) Fans Step Cooling: Pressure Hysteris Step 4	141
(Fr29) Fans Step Cooling: Pressure Hysteris Step 5	141
(Fr30) Fans Step Cooling: Pressure Hysteris Step 6	141
(Fr31) Fans Step Cooling: Pressure Hysteris Step 7	141
(Fr32) Fans Step Cooling: Pressure Hysteris Step 8	141
(H001) MONDAY EVENT #1 ENABLE	116
(H002) MONDAY EVENT #1 HOUR	116
(H003) MONDAY EVENT #1 MIN	116
(H004) MONDAY EVENT #1 MODE	116
(H005) MONDAY EVENT #1 CHILLER SET TEMP ..	116
(H006) MONDAY EVENT #1 HEATPUMP SET TEMP	116

(H007) MONDAY EVENT #2 ENABLE.....	116
(H009) MONDAY EVENT #2 MODE.....	116
(H010) MONDAY EVENT #2 CHILLER SET TEMP...	116
(H011) MONDAY EVENT #2 HEATPUMP SET TEMP	116
(H012) MONDAY EVENT #3 ENABLE.....	116
(H013) MONDAY EVENT #3 HOUR.....	116
(H014) MONDAY EVENT #3 MIN.....	116
(H015) MONDAY EVENT #3 MODE.....	116
(H016) MONDAY EVENT #3 CHILLER SET TEMP...	116
(H017) MONDAY EVENT #3 HEATPUMP SET TEMP	116
(H018) MONDAY EVENT #4 ENABLE.....	117
(H019) MONDAY EVENT #4 HOUR.....	117
(H020) MONDAY EVENT #4 MIN.....	117
(H021) MONDAY EVENT #4 MODE.....	117
(H022) MONDAY EVENT #4 CHILLER SET TEMP...	117
(H023) MONDAY EVENT #4 HEATPUMP SET TEMP	117
(H101) TUESDAY EVENT #1 ENABLE.....	117
(H102) TUESDAY EVENT #1 HOUR.....	117
(H103) TUESDAY EVENT #1 MIN.....	117
(H104) TUESDAY EVENT #1 MODE.....	117
(H105) TUESDAY EVENT #1 CHILLER SET TEMP...	117
(H106) TUESDAY EVENT #1 HEATPUMP SET TEMP	117
(H107) TUESDAY EVENT #2 ENABLE.....	117
(H108) TUESDAY EVENT #2 HOUR.....	117
(H109) TUESDAY EVENT #2 MIN.....	117
(H110) TUESDAY EVENT #2 MODE.....	117
(H111) TUESDAY EVENT #2 CHILLER SET TEMP...	117
(H112) TUESDAY EVENT #2 HEATPUMP SET TEMP	117
(H113) TUESDAY EVENT #3 ENABLE.....	117
(H114) TUESDAY EVENT #3 HOUR.....	117
(H115) TUESDAY EVENT #3 MIN.....	118
(H116) TUESDAY EVENT #3 MODE.....	118
(H117) TUESDAY EVENT #3 CHILLER SET TEMP...	118
(H118) TUESDAY EVENT #3 HEATPUMP SET TEMP	118
(H119) TUESDAY EVENT #4 ENABLE.....	118
(H120) TUESDAY EVENT #4 HOUR.....	118
(H121) TUESDAY EVENT #4 MIN.....	118
(H122) TUESDAY EVENT #4 MODE.....	118
(H123) TUESDAY EVENT #4 CHILLER SET TEMP...	118
(H201) WEDNESDAY EVENT #1 ENABLE.....	118
(H202) WEDNESDAY EVENT #1 HOUR.....	118
(H203) WEDNESDAY EVENT #1 MIN.....	118
(H204) WEDNESDAY EVENT #1 MODE.....	118
(H205) WEDNESDAY EVENT #1 CHILLER SET TEMP	118
(H206) WEDNESDAY EVENT #1 HEATPUMP SET TEMP.....	118

(H207) WEDNESDAY EVENT #2 ENABLE.....	118
(H208) WEDNESDAY EVENT #2 HOUR.....	118
(H209) WEDNESDAY EVENT #2 MIN.....	118
(H210) WEDNESDAY EVENT #2 MODE.....	118
(H211) WEDNESDAY EVENT #2 CHILLER SET TEMP	118
(H212) WEDNESDAY EVENT #2 HEATPUMP SET TEMP.....	119
(H213) WEDNESDAY EVENT #3 ENABLE.....	119
(H214) WEDNESDAY EVENT #3 HOUR.....	119
(H215) WEDNESDAY EVENT #3 MIN.....	119
(H216) WEDNESDAY EVENT #3 MODE.....	119
(H217) WEDNESDAY EVENT #3 CHILLER SET TEMP	119
(H218) WEDNESDAY EVENT #3 HEATPUMP SET TEMP.....	119
(H219) WEDNESDAY EVENT #4 ENABLE.....	119
(H220) WEDNESDAY EVENT #4 HOUR.....	119
(H221) WEDNESDAY EVENT #4 MIN.....	119
(H222) WEDNESDAY EVENT #4 MODE.....	119
(H223) WEDNESDAY EVENT #4 CHILLER SET TEMP	119
(H301) THURSDAY EVENT #1 ENABLE.....	119
(H302) THURSDAY EVENT #1 HOUR.....	119
(H303) THURSDAY EVENT #1 MIN.....	119
(H304) THURSDAY EVENT #1 MODE.....	119
(H305) THURSDAY EVENT #1 CHILLER SET TEMP	119
(H306) THURSDAY EVENT #1 HEATPUMP SET TEMP	119
(H307) THURSDAY EVENT #2 ENABLE.....	120
(H308) THURSDAY EVENT #2 HOUR.....	120
(H309) THURSDAY EVENT #2 MIN.....	120
(H310) THURSDAY EVENT #2 MODE.....	120
(H311) THURSDAY EVENT #2 CHILLER SET TEMP	120
(H312) THURSDAY EVENT #2 HEATPUMP SET TEMP	120
(H313) THURSDAY EVENT #3 ENABLE.....	120
(H314) THURSDAY EVENT #3 HOUR.....	120
(H315) THURSDAY EVENT #3 MIN.....	120
(H316) THURSDAY EVENT #3 MODE.....	120
(H317) THURSDAY EVENT #3 CHILLER SET TEMP	120
(H318) THURSDAY EVENT #3 HEATPUMP SET TEMP	120
(H319) THURSDAY EVENT #4 ENABLE.....	120
(H320) THURSDAY EVENT #4 HOUR.....	120
(H321) THURSDAY EVENT #4 MIN.....	120
(H322) THURSDAY EVENT #4 MODE.....	120
(H323) THURSDAY EVENT #4 CHILLER SET TEMP	120
(H401) FRIDAY EVENT #1 ENABLE.....	120
(H402) FRIDAY EVENT #1 HOUR.....	120
(H403) FRIDAY EVENT #1 MIN.....	121
(H404) FRIDAY EVENT #1 MODE.....	121
(H405) FRIDAY EVENT #1 CHILLER SET TEMP.....	121

(H406) FRIDAY EVENT #1 HEATPUMP SET TEMP	121
(H407) FRIDAY EVENT #2 ENABLE	121
(H408) FRIDAY EVENT #2 HOUR	121
(H409) FRIDAY EVENT #2 MIN	121
(H410) FRIDAY EVENT #2 MODE	121
(H411) FRIDAY EVENT #2 CHILLER SET TEMP	121
(H412) FRIDAY EVENT #2 HEATPUMP SET TEMP	121
(H413) FRIDAY EVENT #3 ENABLE	121
(H414) FRIDAY EVENT #3 HOUR	121
(H415) FRIDAY EVENT #3 MIN	121
(H416) FRIDAY EVENT #3 MODE	121
(H417) FRIDAY EVENT #3 CHILLER SET TEMP	121
(H418) FRIDAY EVENT #3 HEATPUMP SET TEMP	121
(H419) FRIDAY EVENT #4 ENABLE	121
(H420) FRIDAY EVENT #4 HOUR	121
(H421) FRIDAY EVENT #4 MIN	121
(H422) FRIDAY EVENT #4 MODE	121
(H423) FRIDAY EVENT #4 CHILLER SET TEMP	121
(H501) SATURDAY EVENT #1 ENABLE	122
(H502) SATURDAY EVENT #1 HOUR	122
(H503) SATURDAY EVENT #1 MIN	122
(H504) SATURDAY EVENT #1 MODE	122
(H505) SATURDAY EVENT #1 CHILLER SET TEMP	122
(H506) SATURDAY EVENT #1 HEATPUMP SET TEMP	122
(H507) SATURDAY EVENT #2 ENABLE	122
(H508) SATURDAY EVENT #2 HOUR	122
(H509) SATURDAY EVENT #2 MIN	122
(H510) SATURDAY EVENT #2 MODE	122
(H511) SATURDAY EVENT #2 CHILLER SET TEMP	122
(H512) SATURDAY EVENT #2 HEATPUMP SET TEMP	122
(H513) SATURDAY EVENT #3 ENABLE	122
(H514) SATURDAY EVENT #3 HOUR	122
(H515) SATURDAY EVENT #3 MIN	122
(H516) SATURDAY EVENT #3 MODE	122
(H517) SATURDAY EVENT #3 CHILLER SET TEMP	122
(H518) SATURDAY EVENT #3 HEATPUMP SET TEMP	122
(H519) SATURDAY EVENT #4 ENABLE	123
(H520) SATURDAY EVENT #4 HOUR	123
(H521) SATURDAY EVENT #4 MIN	123
(H522) SATURDAY EVENT #4 MODE	123
(H523) SATURDAY EVENT #4 CHILLER SET TEMP	123
(H601) SUNDAY EVENT #1 ENABLE	123
(H602) SUNDAY EVENT #1 HOUR	123
(H603) SUNDAY EVENT #1 MIN	123
(H604) SUNDAY EVENT #1 MODE	123
(H605) SUNDAY EVENT #1 CHILLER SET TEMP	123
(H606) SUNDAY EVENT #1 HEATPUMP SET TEMP	123
(H607) SUNDAY EVENT #2 ENABLE	123
(H608) SUNDAY EVENT #2 HOUR	123

(H609) SUNDAY EVENT #2 MIN	123
(H610) SUNDAY EVENT #2 MODE	123
(H611) SUNDAY EVENT #2 CHILLER SET TEMP	123
(H612) SUNDAY EVENT #2 HEATPUMP SET TEMP	123
(H613) SUNDAY EVENT #3 ENABLE	123
(H614) SUNDAY EVENT #3 HOUR	123
(H615) SUNDAY EVENT #3 MIN	123
(H616) SUNDAY EVENT #3 MODE	124
(H617) SUNDAY EVENT #3 CHILLER SET TEMP	124
(H618) SUNDAY EVENT #3 HEATPUMP SET TEMP	124
(H619) SUNDAY EVENT #4 ENABLE	124
(H620) SUNDAY EVENT #4 HOUR	124
(H621) SUNDAY EVENT #4 MIN	124
(H622) SUNDAY EVENT #4 MODE	124
(H623) SUNDAY EVENT #4 CHILLER SET TEMP	124
(Hm01) Sat-Sun Event #1 Enable	125
(Hm02) Sat-Sun Event #1 Hour	125
(Hm03) Sat-Sun Event #1 Min	125
(Hm04) Sat-Sun Event #1 Mode	125
(Hm05) Sat-Sun Event #1 Chiller set Temp	125
(Hm06) Sat-Sun Event #1 HeatPump set Temp	125
(Hm07) Sat-Sun Event #2 Enable	125
(Hm08) Sat-Sun Event #2 Hour	125
(Hm09) Sat-Sun Event #2 Min	125
(Hm10) Sat-Sun Event #2 Mode	125
(Hm11) Sat-Sun Event #2 Chiller set Temp	125
(Hm12) Sat-Sun Event #2 HeatPump set Temp	125
(Hm13) Sat-Sun Event #3 Enable	125
(Hm14) Sat-Sun Event #3 Hour	125
(Hm15) Sat-Sun Event #3 Min	126
(Hm16) Sat-Sun Event #3 Mode	126
(Hm17) Sat-Sun Event #3 Chiller set Temp	126
(Hm18) Sat-Sun Event #3 HeatPump set Temp	126
(Hm19) Sat-Sun Event #4 Enable	126
(Hm20) Sat-Sun Event #4 Hour	126
(Hm21) Sat-Sun Event #4 Min	126
(Hm22) Sat-Sun Event #4 Mode	126
(Hm23) Sat-Sun Event #4 Chiller set Temp	126
(Hr01) Heat Recovery: Pressure Set Point	129
(Hr02) Heat Recovery: Pressure Hysteresis	129
(Hr03) Heat Recovery: Minimum Time	129
(Hr04) Heat Recovery: Bypass Time	129
(Hr05) Heat Recovery: Cooling Min Time	129
(Hr06) Heat Recovery:Temp Set Point	129
(Hr07) Heat Recovery: Proportional Band	129
(Hr08) Heat Recovery: Sensor	129
(Hr09) Heat Recovery: Flow Switch Presence	130
(Hr10) Heat Recovery: Pump Presence	130
(Hr11) Heat Recovery: Temperature Sensor Presence	130

(Hr12) Heat Recovery: Pressure Digital Input Presence	130
(Hr13) Heat Recovery: Three Way Valve Presence	130
(Hr14) Heat Recovery: Enable	130
(Hs01) Week Event #1 Enable	126
(Hs02) Week Event #1 Hour	126
(Hs03) Week Event #1 Min	126
(Hs04) Week Event #1 Mode	126
(Hs05) Week Event #1 Chiller set Temp	126
(Hs06) Week Event #1 HeatPump set Temp	126
(Hs07) Week Event #2 Enable	126
(Hs08) Week Event #2 Hour	126
(Hs09) Week Event #2 Min	126
(Hs10) Week Event #2 Mode	126
(Hs11) Week Event #2 Chiller set Temp	126
(Hs12) Week Event #2 HeatPump set Temp	126
(Hs13) Week Event #3 Enable	126
(Hs14) Week Event #3 Hour	126
(Hs15) Week Event #3 Min	127
(Hs16) Week Event #3 Mode	127
(Hs17) Week Event #3 Chiller set Temp	127
(Hs18) Week Event #3 HeatPump set Temp	127
(Hs19) Week Event #4 Enable	127
(Hs20) Week Event #4 Hour	127
(Hs21) Week Event #4 Min	127
(Hs22) Week Event #4 Mode	127
(Hs23) Week Event #4 Chiller set Temp	127
(Hw01) Mon-Fri Event #1 Enable	124
(Hw02) Mon-Fri Event #1 Hour	124
(Hw03) Mon-Fri Event #1 Min	124
(Hw04) Mon-Fri Event #1 Mode	124
(Hw05) Mon-Fri Event #1 Chiller set Temp	124
(Hw06) Mon-Fri Event #1 HeatPump set Temp	124
(Hw07) Mon-Fri Event #2 Enable	124
(Hw08) Mon-Fri Event #2 Hour	124
(Hw09) Mon-Fri Event #2 Min	124
(Hw10) Mon-Fri Event #2 Mode	124
(Hw11) Mon-Fri Event #2 Chiller set Temp	124
(Hw12) Mon-Fri Event #2 HeatPump set Temp	124
(Hw13) Mon-Fri Event #3 Enable	124
(Hw14) Mon-Fri Event #3 Hour	124
(Hw15) Mon-Fri Event #3 Min	124
(Hw16) Mon-Fri Event #3 Mode	125
(Hw17) Mon-Fri Event #3 Chiller set Temp	125
(Hw18) Mon-Fri Event #3 HeatPump set Temp	125
(Hw19) Mon-Fri Event #4 Enable	125
(Hw20) Mon-Fri Event #4 Hour	125
(Hw21) Mon-Fri Event #4 Min	125
(Hw22) Mon-Fri Event #4 Mode	125
(Hw23) Mon-Fri Event #4 Chiller set Temp	125
(Mc01) Cooling: Set Point	137
(Mc02) Cooling: Min Set Point	137
(Mc03) Cooling: MAX Set Point	137

(Mc04) Cooling: Inlet Water Temp Offset	137
(Mc05) Cooling: Proportional Band	137
(Mc06) Cooling: Min Proportional Band	137
(Mc07) Cooling: MAX Proportional Band	137
(Mc08) Cooling: Incremental Step Time	137
(Mc09) Cooling: Decremental Step Time	137
(Mh01) Heating: Set Point	137
(Mh02) Heating: Min Set Point	137
(Mh03) Heating: MAX Set Point	137
(Mh04) Heating: Proportional Band	137
(Mh05) Heating: Min Proportional Band	137
(Mh06) Heating: MAX Proportional Band	137
(Mh07) Heating: Inc. Step Time	137
(Mh08) Heating: Dec. Step Time	137
(Mh09) Heating: Inlet Water Temp Offset	137
(Pd01) PumpDown: Min Pressure Set point	128
(Pd02) PumpDown: MAX Pressure Set Point	128
(Pd03) PumpDown: Off-On MAX Time	128
(Pd04) PumpDown: On-Off MAX Time	128
(Pd05) PumpDown: Type	128
(Pd06) PumpDown: Sensor T/P	128
(Pd07) PumpDown: Solenoid Valve Presence	128
(Pd08) PumpDown: Pressure Digital Input Presence	128
(Pd09) PumpDown: Soft Pump Down Algorithm Enable	128
(PI01) TREG-PI: INTEGRATIVE COSTANT	137
(PI02) TREG-PI: USE INTEGRATIVE COMPONENT	137
(PI03) TREG-PI: USE PROPORTIONAL COMPONENT	138
(Pp01) Pumpgroup: Comp Stop Delay on Pump Rotation	144
(Pp02) Pumpgroup: Pump ON - compressors ON delay	144
(Pp03) Pumpgroup: Compressor OFF - pump OFF delay	144
(Pp04) Pumpgroup: Pump ON - compressors ON delay (on demand)	144
(Pp05) Pumpgroup: Compressor OFF - pump OFF delay (on demand)	144
(Pp06) Pumpgroup: Flow Switch Alarm Auto->Man Time	144
(Pp07) Pumpgroup: Flow Switch Alarm Bypass Startup Time	144
(Pp08) Pumpgroup: Flow Switch Alarm Entry Time	144
(Pp09) Pumpgroup: Flow Switch Alarm Exit Time	144
(Pp10) Pumpgroup: Pump Rotation Time	144
(Pp11) Pumpgroup: Control Type	144
(Pp12) Pumpgroup: Comp Stop on Pump Rotation Enable	144
(Rv01) Reversing Valve Presence	130
(Sp01) Soft Start Time	135

(Sp02) Unit Starting Mode.....	135	(X013) (IE) OFFSET PROBE AI11	110
(Sp03) Evaporators' Selection Logic	135	(X014) (IE) OFFSET PROBE AI12	110
(Sp04) Circuits' Selection Logic.....	135	(X015) (IE) PRESSURE VALUE 4MA PROBE AI9....	110
(Sp05) Compressors' Selection Logic.....	135	(X016) (IE) PRESSURE VALUE 20MA PROBE AI9...	110
(Sp06) Reversible Heat-Pump Enable.....	135	(X017) (IE) PRESSURE VALUE 4MA PROBE AI10..	110
(Sp07) Soft Start Enable Enable	135	(X018) (IE) PRESSURE VALUE 20MA PROBE AI10.	110
(Sp08) Machine Reversal Remote Input Presence	136	(X019) (IE) PRESSURE VALUE 4MA PROBE AI11..	110
(Sp09) Remote OFF Input Presence.....	136	(X020) (IE) PRESSURE VALUE 20MA PROBE AI11.	110
(St01) Dynamic Tset: External Temp Set for Cooling		(X021) (IE) PRESSURE VALUE 4MA PROBE AI12..	110
.....	128	(X022) (IE) PRESSURE VALUE 20MA PROBE AI12.	110
(St02) Dynamic Tset: External Temp Set for Heating		(X101) EXPANSION #1 (EXP #1) TYPE.....	110
.....	128	(X102) EXPANSION #1 (EXP #1) ENABLING	110
(St03) Dynamic Tset: Maximum Offset for Cooling		(X103) EXPANSION #1 (EXP #1) UT.....	110
.....	128	(X104) (EXP #1) PROBES AI1...AI4 TYPE DUMMY	110
(St04) Dynamic Tset: Maximum Offset for Heating		(X105) (EXP #1) PROBES AI1 AI2 TYPE.....	110
.....	128	(X106) (EXP #1) PROBES AI3 AI4 TYPE	110
(St05) Dynamic Tset: Delta Temp for Cooling.....	129	(X107) (EXP #1) OFFSET PROBE AI1 DUMMY.....	110
(St06) Dynamic Tset: Delta Temp for Heating	129	(X108) (EXP #1) OFFSET PROBE AI2 DUMMY.....	110
(St07) Dynamic Tset: Thermal Regulation Type ...	129	(X109) (EXP #1) OFFSET PROBE AI3DUMMY.....	111
(St08) Dynamic Tset: Thermal Regulation Sensor	129	(X110) (EXP #1) OFFSET PROBE AI4 DUMMY.....	111
(St09) Dynamic Tset: Enable.....	129	(X111) (EXP #1) OFFSET PROBE AI1.....	111
(St10) Temp Sensor Shared for Evaporators Enable		(X112) (EXP #1) OFFSET PROBE AI2.....	111
.....	129	(X113) (EXP #1) OFFSET PROBE AI3.....	111
(Sy01) Evaporators Number	127	(X114) (EXP #1) OFFSET PROBE AI4.....	111
(Sy02) Evaporators Min Number	127	(X115) (EXP #1) PRESSURE VALUE 4MA PROBE AI1	
(Sy03) Evaporators MAX Number	127	.....	111
(Sy04) Circuits Number.....	127	(X116) (EXP #1) PRESSURE VALUE 20MA PROBE AI1	
(Sy05) Circuits Min Number	127	.....	111
(Sy06) Circuits MAX Number	127	(X117) (EXP #1) PRESSURE VALUE 4MA PROBE AI2	
(Sy07) Compressors Number	127	.....	111
(Sy08) Compressors Min Number.....	127	(X118) (EXP #1) PRESSURE VALUE 20MA PROBE AI2	
(Sy09) Compressors MAX Number.....	127	.....	111
(Sy10) Pumps Number	127	(X119) (EXP #1) PRESSURE VALUE 4MA PROBE AI3	
(Sy11) Plant Type	127	.....	111
(Sy12) Pump Group Enable.....	128	(X120) (EXP #1) PRESSURE VALUE 20MA PROBE AI3	
(Sy13) Dynamic Tset External Temperature Sensor		.....	111
.....	128	(X121) (EXP #1) PRESSURE VALUE 4MA PROBE AI4	
(Sy14) Dynamic Tset Current Sensor	128	.....	111
(Sy15) Machine Type.....	128	(X122) (EXP #1) PRESSURE VALUE 20MA PROBE AI4	
(Sy16) Combine Condensation	128	.....	111
(Sy17) Number of Fans Groups.....	128	(X201) EXPANSION #2 (EXP #2) TYPE.....	111
(X001) INTERNAL EXPANSION (IE) TYPE	109	(X202) EXPANSION #2 (EXP #2) ENABLING	111
(X002) INTERNAL EXPANSION (IE) ENABLING	109	(X203) EXPANSION #2 (EXP #2) UT.....	111
(X003) INTERNAL EXPANSION (IE) UM	109	(X204) (EXP #2) PROBES AI1...AI4 TYPE DUMMY	111
(X004) (IE) PROBES AI13...AI6 TYPE	109	(X205) (EXP #2) PROBES AI1 AI2 TYPE.....	111
(X005) (IE) PROBES AI9 AI10 TYPE	109	(X206) (EXP #2) PROBES AI3 AI4 TYPE	111
(X006) (IE) PROBES AI11 AI12 TYPE.....	109	(X207) (EXP #2) OFFSET PROBE AI1 DUMMY.....	112
(X007) (IE) OFFSET PROBE AI13.....	109	(X208) (EXP #2) OFFSET PROBE AI2 DUMMY.....	112
(X008) (IE) OFFSET PROBE AI14.....	109	(X209) (EXP #2) OFFSET PROBE AI3DUMMY.....	112
(X009) (IE) OFFSET PROBE AI15.....	110	(X210) (EXP #2) OFFSET PROBE AI4 DUMMY.....	112
(X010) (IE) OFFSET PROBE AI16.....	110	(X211) (EXP #2) OFFSET PROBE AI1.....	112
(X011) (IE) OFFSET PROBE AI9.....	110	(X212) (EXP #2) OFFSET PROBE AI2.....	112
(X012) (IE) OFFSET PROBE AI10.....	110	(X213) (EXP #2) OFFSET PROBE AI3.....	112

(X214) (EXP #2) OFFSET PROBE AI4	112
(X215) (EXP #2) PRESSURE VALUE 4MA PROBE AI1	112
(X216) (EXP #2) PRESSURE VALUE 20MA PROBE AI1	112
(X217) (EXP #2) PRESSURE VALUE 4MA PROBE AI2	112
(X218) (EXP #2) PRESSURE VALUE 20MA PROBE AI2	112
(X219) (EXP #2) PRESSURE VALUE 4MA PROBE AI3	112
(X220) (EXP #2) PRESSURE VALUE 20MA PROBE AI3	112
(X221) (EXP #2) PRESSURE VALUE 4MA PROBE AI4	112
(X222) (EXP #2) PRESSURE VALUE 20MA PROBE AI4	112
(X301) EXPANSION #3 (EXP #3) TYPE	112
(X302) EXPANSION #3 (EXP #3) ENABLING	112
(X303) EXPANSION #3 (EXP #3) UT	112
(X304) (EXP #3) PROBES AI1...AI4 TYPE DUMMY	112
(X305) (EXP #3) PROBES AI1 AI2 TYPE	113
(X306) (EXP #3) PROBES AI3 AI4 TYPE	113
(X307) (EXP #3) OFFSET PROBE AI1 DUMMY	113
(X308) (EXP #3) OFFSET PROBE AI2 DUMMY	113
(X309) (EXP #3) OFFSET PROBE AI3 DUMMY	113
(X310) (EXP #3) OFFSET PROBE AI4 DUMMY	113
(X311) (EXP #3) OFFSET PROBE AI1	113
(X312) (EXP #3) OFFSET PROBE AI2	113
(X313) (EXP #3) OFFSET PROBE AI3	113
(X314) (EXP #3) OFFSET PROBE AI4	113
(X315) (EXP #3) PRESSURE VALUE 4MA PROBE AI1	113
(X316) (EXP #3) PRESSURE VALUE 20MA PROBE AI1	113
(X317) (EXP #3) PRESSURE VALUE 4MA PROBE AI2	113
(X318) (EXP #3) PRESSURE VALUE 20MA PROBE AI2	113
(X319) (EXP #3) PRESSURE VALUE 4MA PROBE AI3	113
(X320) (EXP #3) PRESSURE VALUE 20MA PROBE AI3	113
(X321) (EXP #3) PRESSURE VALUE 4MA PROBE AI4	113
(X322) (EXP #3) PRESSURE VALUE 20MA PROBE AI4	113
(X401) EXPANSION #4 (EXP #4) TYPE	113
(X402) EXPANSION #4 (EXP #4) ENABLING	113
(X403) EXPANSION #4 (EXP #4) UT	113
(X404) (EXP #4) PROBES AI1...AI4 TYPE DUMMY	114
(X405) (EXP #4) PROBES AI1 AI2 TYPE	114
(X406) (EXP #4) PROBES AI3 AI4 TYPE	114

(X407) (EXP #4) OFFSET PROBE AI1 DUMMY	114
(X408) (EXP #4) OFFSET PROBE AI2 DUMMY	114
(X409) (EXP #4) OFFSET PROBE AI3 DUMMY	114
(X410) (EXP #4) OFFSET PROBE AI4 DUMMY	114
(X411) (EXP #4) OFFSET PROBE AI1	114
(X412) (EXP #4) OFFSET PROBE AI2	114
(X413) (EXP #4) OFFSET PROBE AI3	114
(X414) (EXP #4) OFFSET PROBE AI4	114
(X415) (EXP #4) PRESSURE VALUE 4MA PROBE AI1	114
(X416) (EXP #4) PRESSURE VALUE 20MA PROBE AI1	114
(X417) (EXP #4) PRESSURE VALUE 4MA PROBE AI2	114
(X418) (EXP #4) PRESSURE VALUE 20MA PROBE AI2	114
(X419) (EXP #4) PRESSURE VALUE 4MA PROBE AI3	114
(X420) (EXP #4) PRESSURE VALUE 20MA PROBE AI3	114
(X421) (EXP #4) PRESSURE VALUE 4MA PROBE AI4	114
(X422) (EXP #4) PRESSURE VALUE 20MA PROBE AI4	114
3	
3-way valve	25
A	
Active fans with condensation probe alarm	32
Advanced ignition policy	36
Advanced start policy	50
Alarm due to heat recovery input temperature probe error	104
Alarms Menu	14
Alarms_history_list	14
Alarms_regulation	14
Anti-freeze alarm of the secondary circuit	106
Anti-freeze electric heaters	22
Anti-freeze probe error alarm	104
Apploader	4
ARW	149
Automatic circuit alarm	103
Automatic circuit pump down alarm	103
Available defrost functions	71
Average hours	148
B	
Balancing	49
BLINK	148
C	
Call-outs	3
Capacity step timing	36
CARD_0_Mode	11
CARD_1_Mode	11
Changing the set point with a temperature sensor	76

Changing the set point with the current sensor	76	Compressors>Error signals.....	34
Circuit balancing.....	50	Compressors:Linked components	33
Circuit saturation.....	50	Compressors_CARD_0	11
Circuit selection policies	49	Compressors_CARD_1	12
Circuits.....	24	Compressors_CARD_2	12
Circuits Menu.....	13	Condenser control.....	28
Circuits: Pressure sensors.....	25	Condenser control:Temperature sensor	28
Circuits: Pump Down.....	26	Condenser defrosting.....	28
Circuits: Pump Down:Pressure.....	26	Condenser group	27
Circuits: Pump Down:probe.....	26	Condenser group>Error signals	27
Circuits: valves	25	Condenser group:Linked components	27
Circuits: valves:Solenoid valve.....	25	Condenser group:Number of fans	28
Circuits:Configuration.....	25	Conditions that disable defrost.....	74
Circuits>Error signals.....	24	Conditions that disable defrost:Compressors	74
Circuits:Linked components.....	24	Conditions that disable defrost:Electric heaters	
Circuits_11.....	13	.....	75
Circuits_11_CARD_0	13	Conditions that disable defrost:Energy 400	74
Circuits_11_CARD_1	13	Conditions that disable defrost:Fast inversion.....	74
Circuits_11_CARD_2	14	Conditions that disable defrost:Fast inversion wpd.....	74
Circuits_CARD_0	13	Conditions that disable defrost:Reversing valve	
Class C	4	.....	75
Class F	4	Conditions that disable defrost:Soft inversion.....	74
Class H	4	Configuration Wizard.....	4
Cm05.....	115	Continuous fans control: cooling	68
Cm06.....	115	Control during defrost.....	72
Cm07.....	115	Control during defrost:Compressors	73
Cm08.....	115	Control during defrost:Electric heaters	74
Compensation function.....	73	Control during defrost:Energy 400	73
Compressor alarms.....	86	Control during defrost:Fans	72
Compressor balancing.....	49	Control during defrost:Fast inversion	73
Compressor probe error alarm	104	Control during defrost:Fast inversion wpd	73
Compressor safety.....	34	Control during defrost:Reversing valve	73
Compressor safety:Pressure sensors.....	35	Control during defrost:Soft inversion.....	73
Compressor safety:Temperature sensors	35	Control failure.....	102
Compressor saturation	49	Control functions of the pump group.....	41
Compressor selection policies	49	Control functions of the pump group:Individual	41
Compressor swap	35	Control of flow switch alarms	96
Compressor thermal alarms.....	86	Control with fan of equal/different power	66
Compressor timing	35	Control with fan of equal/different power:Different	
Compressor timing:Max starts per hour.....	36	power	66
Compressor timing:Off/on timing	35	Control with fan of equal/different power:Equal	
Compressor timing:On/off timing	35	power	66
Compressor timings with capacity steps	36	cooling.....	57
Compressor_111	12	Cooling.....	52
Compressor_111_CARD_0.....	12	Cooling control of the compressor's discharge	
Compressor_111_CARD_1.....	12	temperature (liquid injection) -	37
Compressor_211_reset_hours.....	12	Cooling proportional band	55
Compressor_421_reset_hours.....	13	Cooling set point	55
Compressors.....	33	Copy Settings function	54
Compressors Menu	11	Cross references	3
Compressors with capacity steps.....	34	Cut-off.....	148
Compressors: selection algorithms	34	Cut-Off by-pass	68
Compressors:Alarms.....	33		

D

Defrost	71
Defrost enabling conditions	72
Defrost enabling conditions:Timing interruption	72
Defrost enabling conditions:Timing reset.....	72
Defrost with cycle reversal	71
Defrost with electric heaters.....	71
Defrost: shared parameters	71
DIAGNOSTICS	86
DISCLAIMER.....	147
Dynamic defrost set point.....	75
Dynamic set point.....	59
Dynamic set point with current sensor.....	59
Dynamic set point with current sensor:cooling	60
Dynamic set point with current sensor:heating	60
Dynamic set point with temperature sensor.....	60
Dynamic set point with temperature sensor:cooling	61
Dynamic set point with temperature sensor:heating	61
Dynamic set point: sensor	20

E

Enabling a time band.....	53
Enter_(Cg12) Config Password	15
Enter_(Cg12) Config Password_CARD_0.....	15
Evaporator anti-freeze alarm	94
Evaporator anti-freeze alarm of the secondary circuit.....	96
Evaporator balancing	50
Evaporator group.....	21
Evaporator group:Configuration.....	22
Evaporator group>Error signals.....	21
Evaporator group:Linked components.....	21
Evaporator group:Number of circuits	22
Evaporator saturation.....	50
Evaporator selection policies.....	50
Evaporators: selection algorithms.....	22
Example of flow switch alarm.....	98

F

Fan group	31
Fan group:Alarms	31
Fan group:Configuration.....	31
Fan group:continuous.....	31
Fan group:digital	31
Fan group:Linked components	31
Fan group:maxpower	31
Fans control in continuous mode (continuous).....	67
FANS REGULATOR.....	62
FANS REGULATOR:continuous.....	62
FANS REGULATOR:digital	62
FANS REGULATOR:maxpower.....	62
Fans: activation	62
Fans: regulation probes.....	62

Fans: regulation probes:Regulation in pressure mode	62
Fans: regulation probes:Regulation in temperature mode	62
Fixed probes	45
Flow alarms control.....	97
Forcing pumps in test mode	42
Free cooling	77
Free cooling flow switch alarm	101
Free cooling probe error alarm	105
Free cooling pump	19
Free cooling pump thermal alarm	101
Free cooling pump:Pressure	19
Free cooling: circuit control	80
Free cooling: circuit control:With active circuits	80
Free cooling: circuit control:With inactive circuits	80
Free cooling: condensation pressure.....	80
Free cooling: disabling	79
Free cooling: enabling	79
Free cooling: temperature control.....	78
Free cooling: temperature control:Diagram	78
Free cooling:Components	77
Function Menu	10
Function_CARD_0	10
FUNCTIONS	71
G	
GLOSSARY	148
H	
Heat recovery.....	84
Heat recovery : activation.....	84
Heat recovery : activation:3-way valves	84
Heat recovery : activation:Fans in Cooling with heat recovery	84
Heat recovery : Forcing to chiller without heat recovery.	84
Heat recovery flow switch alarm	101
Heat recovery pump thermal switch alarm.....	101
Heat recovery: probes.....	19
Heat recovery: water pump.....	19
Heat recovery:Components	84
Heating	52
Heating proportional band.....	55
Heating set point.....	55
High discharge temperature alarm.....	86
High temperature alarm.....	102
Highlighted icons.....	3
Hydraulic pump not managed directly by the controller.....	42
Hysteresis	148
I	
Integration electric heaters.....	22

INTRODUCTION	4
L	
Loads.....	148
Logical OR.....	148
Low temperature alarm.....	103
M	
Main components of a circuit.....	4
Manual reset.....	148
Max. time with reduced power	36
Maximum pressure alarm of circuits.....	93
Maxpower fans control (on/off)	70
Menu.....	10
Minimum pressure alarm of circuits.....	88
Minimum pressure alarm of circuits:Diagrams.....	90
Mode Menu	10
N	
Non volatile memory	148
O	
Oil differential pressure alarm of compressors	86
Oil pressure switch alarm of compressors.....	87
Oil pressure: probes	25
On/On timing.....	35
Operating mode	52
P	
PARAMETERS TABLE	108
Part Winding	34
Permitted Use.....	145
PI temperature control	59
PI temperature control:Parameters	59
PID	148
Preventive anti-freeze.....	95
Probe configurability.....	42
Probe configuration.....	43
Probe errors	104
Probe limitations.....	47
Probes on compressors	47
Proportional temperature control.....	56
Proportional temperature control:heating	58
Pump control: a few examples.....	42
Pump Down.....	80
Pump down: probes.....	81
Pump down: start.....	81
Pump down: stop	82
Pump down: timing	82
Pump Down:Components	80
Pump Down:Mode	81
Pump group.....	40
Pump group timing	41
Pump group:Alarms	40
Pump group:Linked components.....	40
Pump Menu	14
R	
Range.....	148
RapidAccess.....	9

RapidAccess_CARD_0.....	9
RapidAccess_CARD_1	9
Recording the hours of operation.....	71
Remote Heating/Cooling	52
Remote On/Off.....	52
Reset	148
Resetting	148
RESOURCES' SELECTION POLICIES.....	48
RESPONSIBILITY AND RESIDUAL RISKS	146
Reversible systems	18
Reversing valve.....	25
S	
Saturated circuit.....	49
Saturated compressor	49
Saturation	48
Scroll down	148
Scroll up.....	148
Selectable fan thermal switch	32
Selecting the circuit selection algorithm	25
Selecting the compressor selection algorithm.....	34
Selecting the evaporator selection algorithm	22
Selecting the mode from the keyboard	52
Set Point	148
Simplified pump down sequence	83
Simultaneous defrost.....	72
Single condensing	28
Single defrost.....	71
Standby.....	52; 148
Star/delta start with open transition.....	37
Start mode	18
Start mode:Soft start	19
Starting the system	18
Status Menu.....	11
Step fan control (digital)	62
Step fan control (digital):Steps activation	63
Step fan control (digital):Steps deactivation	63
Stepping fan control: cooling	63
Stepping fan control: heating.....	64
Symbols.....	5
SYSTEM CONFIGURATION	17
System: Dynamic set point	20
System: Heat recovery	19
System_Alarms	14
T	
Table.....	44; 45
Temperature control anomalies	56
Temperature control functions: anomalies	56
Temperature control in Cooling mode.....	55
Temperature control in Cooling mode:Timers.....	55
Temperature control in Heating mode	55
Temperature control in Heating mode:Timers	56
Temperature control probe error alarm	105
Temperature control sensors	54

Temperature sensor	22	Types of temperature control	56
THERMOREGULATION	52	Types of temperature control:'PI' temperature control	56
Time band mode	53	Types of temperature control:Proportional time control	56
Time band set point.....	53	Types of temperature control:Time-proportional temperature control	56
Time band start time.....	53	Types of timers	53
Time band: COOLING	54	U	
Time band: HEATING	53	Unavailable pump alarm	101
Time band: LOCAL SET	54	Unpermitted Use.....	145
Time band: MANUAL	54	USE OF MANUAL	3
Time band: OFF	53	USE OF THE DEVICE	145
Time bands	52	USER INTERFACE.....	6
Time Bands Menu	15	User_Parameters	15
Time_Band_Copy_functions	16	V	
Time_Bands_Settings	15	Valve thermal alarms	88
Time_Bands_Settings_CARD_0.....	15	W	
Time_Bands_Settings_CARD_1	16	Water pump alarm control.....	102
Time_Bands_Settings_CARD_2	16	Water pump failure.....	102
Time-proportional temperature control.....	58	Water pump of secondary circuit	106
Time-proportional temperature control:Diagram ..	58	Water pump thermal alarm	100
Type of system.....	17	WATER WATER DEVICES	106
Type of system:Alarms	18	with active probe reversal	44
Type of system>Error signals.....	18	X	
Type of system:Evaporators	18	XT MenuMaker	4
Type of system:Linked components	17		
Type of system:Pump group	18		
Type of system:Type.....	18		
Types of probes	42		



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