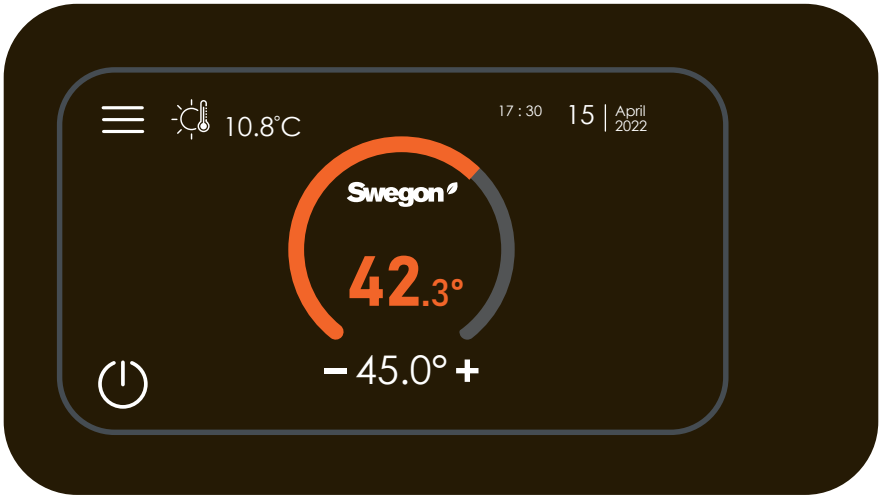
Controller manual

EN

Service

06-02-2025



Series:

Epsilon Sky

BlueBox by Swegon

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Contents

1 INTRODUCTION

1.1 General

Some information on the use of this manual.

1.1.1 Purpose of the manual

The purpose of this manual is to provide all information regarding the software functions of the controller for the units listed on the cover and it is complementary to the controller installation and programming manual.

This manual is the “SERVICE” version, that is, it is intended only for after-sales service technicians and Factory technicians.

Information regarding installation of the units and relevant tests and checks for the first starting is not given in this manual.

It is taken for granted that the unit has been installed correctly, the tests and checks prior to start-up have been carried out and that routine maintenance is carried out, according to the information given in the “Installation, operation and maintenance” manual for the units.

We thank in advance all those who will wish to let us know of any errors, omissions, sections requiring further explanation or operations that have not been included.

1.1.2 iPRO_Lite controller functions

The software application for the electronic microprocessor controller of the iProLite series was designed to manage refrigerant units and heat pumps.

Through appropriate configuration, this gives the possibility of managing a wide range of units with relevant specific functionalities.

By management of refrigerant units we mean safe control of operation of their component parts, during their various operating stages.

There are various sizes of modules in the iPro electronic microprocessor controller family. Through flexibility of the software, this allows their use to be optimized by using those that have the necessary number of inputs and outputs for each application.

Other expansion modules are used for unit control in addition to the iProLite microprocessor controller.

The iProLite board is connected to the various modules and communicates with them via a high speed, highly reliable field bus.

The user interface of the controller consists in a high resolution touch screen display.

1.1.3 Recommendations for digital security

This unit is designed for connection to an Ethernet network.

Unit networking must be implemented by technicians who can take the appropriate security measures required to prevent system violations.

In particular:

- We recommend that access to the unit controller be restricted to the network inside the organization. System exposure to the Internet is strongly not recommended.
- If remote access is required, the connection must be encrypted via SSL/TLS or VPN and through a firewall configuration within the internal IT environment.
- The authorization to use a remote access must only be granted to equipment that the organization has supplied and approved, as specified in the previous item.

2 THE SCREENS

2.1 User Interface

The display is the interface between the unit and the user. The display is the tool used for interaction with the unit and for access to parameters.

Information regarding installation of the units and relevant tests and checks for the first starting is not given in this manual.

Navigate through the various menus to access the screens where you can carry out the necessary operations for operation of the unit, edit the operating parameters and download the records.

The images and the values shown in the screens are for illustrative purposes only.
They can vary according to the configurations and functions featured in the controller.

2.1.1 Home page

The display switches off after it has been inactive for a while. The time during which the display is ON is set up in the video display management page(s) of the user menu.

When the display is touched, access is gained to the main screen. The “LH arrow” is pressed to go back to the main screen.

The main screen is the starting point for navigating through the various branches of the application.

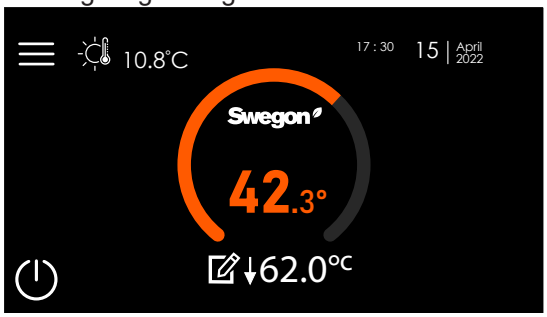


Fig. 1 Home page

The “On-Off” icon is featured on the bottom left-hand side of the screen and it is pressed to start/stop the unit.

The “Controls Menu” icon is featured on the top left-hand side of the main screen. The “Controls Menu” icon is sided by the symbol of the outside air temperature, which shows the detected value.

The date and time are displayed on the top right-hand side. Refer the “Changing the time and date” chapter for the procedure to edit the date and the time.

The central part of the screen shows base information on the operating status of the unit.

The colour of the dial shows the operating status.

Grey indicates that the unit is off; orange indicates operation in heating mode; and cyan indicates operation in cooling mode.

The value inside the box is the reference water temperature value.

The bottom part of the screen shows the operating setpoint. Refer to the “Changing the setpoint” chapter to edit the setpoint value.

The right-hand side of the screen indicates the enabled functions. Symbols are provided to indicate the various functions.
The symbols of the functions are as follows.

The “**Alarm**” symbol indicates that at least one alarm is active: the figure aside the symbol indicates the number of active alarms.

The “**Night Shift System**” symbol indicates that the “Night Shift System” function is active. Refer to the section titled “Night Shift System” for further information on how to manage this function.

The “**Energy saving**” symbol indicates that the “Energy Saving” function is active. Refer to the section titled “Time bands” for further information on how to manage this function.

The “**Set OFF Time**” symbol indicates that the “Set OFF Time” function is active. Refer to the section titled “Time bands” for further information on how to manage this function.

2.1.2 Screen tree

The user interface gives access to any and all information on the operating parameters of the unit. The software manual describes the access procedure to the desired information and to the parameter pages where the various functions can be set up.

Menus are also provided, which the user can browse, to find additional information to that given in the main screen. For easier browsing, the screen tree is given below.

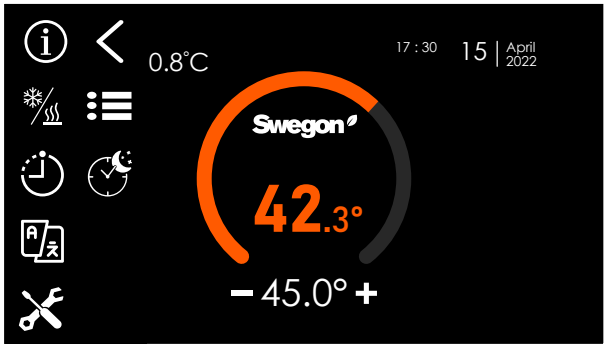
- **Side Menu**
  - **Info**
  - **Close side menu**
  - **summer/winter**
  - **User Menu**
    - **Alarm History**
    - **Video display**
      - **Back-lighting**
      - **LED**
      - **Font**
      - **Network**
    - **Network**
    - **File Management**
  - **Time bands**
  - **Night Shift System**
  - **Languages**
  - **Protected Menus**
    - **Setpoint**
    - **I/O**
    - **Compressors**
    - **Alarm History**
    - **Control Panel**
      - **Parameter File Management**
      - **Log File Management**
      - **System Information**
    - **Refrigerant Circuit**
    - **Pumps**

Access to the protected menus requires entry of the relevant password.

The “Maintenance” password is “200”.

2.1.3 Controls Menu

The icon “Controls Menu” opens a drop-drown menu featuring icons giving access to the other menus.

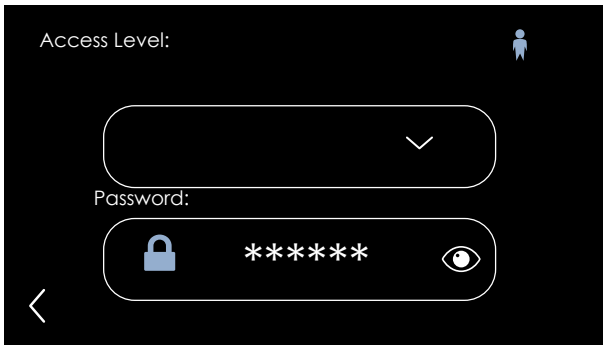


The icons featured in this menu give access to all available information and parameters.

Login using personal credentials is necessary to browse password-protected menus. After login, it is possible to gain access to a protected menu for the following thirty minutes without having to enter the password again.

2.1.4 Access to protected menus

The “Access” icon gives access to the screen where the user can log in to access the password-protected menus.



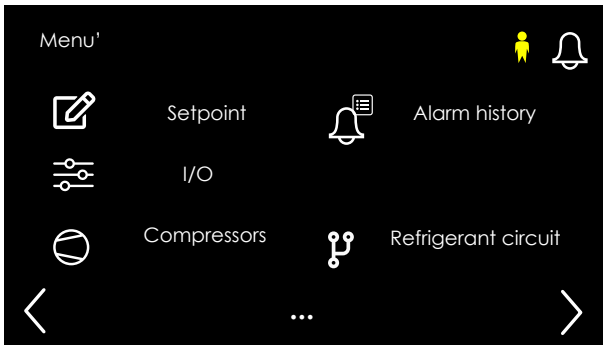
In the top area, the user has to select the profile for which he has credentials to access the protected menus.

The bottom area is used to enter the password.

A click on the asterisks enables the virtual keypad used for password entry.

The password needs to be confirmed by clicking the green tick symbol located on the right-hand side of the keypad.

Tap on the “RH arrow” icon to confirm the request for access. Entry of the correct password gives access to the protected menu screen.



Once in the protected menus, you can browse them for an unlimited period of time.

When you exit password-protected menus, you can enter them again without having to log in for the following thirty minutes.

When you log in, the symbol “**logout**” appears in the “Command menu”: this symbol is used to override exit from the protected menus, which would in any case occur automatically thirty minutes after access.

2.1.5 Access to the Parameters menu

The icon “Parameters” is featured in the screen loop of password-protected menus.

The icon “Parameters” gives access to the screens with the unit operating parameters that are split into homogeneous groups.

The following groups are present:

- “ST : Thermoregulation”, in which the parameters of group “ST” are stored;
- "CF : Configuration", in which the parameters of group "CF" are located;
- "SP : Machine set-up", in which the parameters of group "SP" are located;
- “SD: Dynamic Setpoint”, in which the parameters of group “SD” are stored;
- "ES : ES and automatic ON/OFF", in which the parameters of group "ES" are located;
- "AH: Auxiliary heating", in which the parameters of group "AH" are located;
- "CO : Compressor", in which the parameters of group "CO" are located;
- "PA : Water pump", in which the parameters of group "PA" are located;
- “UN: Unloading”, in which the parameters of group “UN” are stored;
- "FA : Ventilation", in which the parameters of group "FA" are located;
- “AR: Anti-freeze Heaters”, in which the parameters of group “AR” are stored;
- “DF: Defrost”, in which the parameters of group “DF” are stored;
- “SDH: Desuperheater”, in which the parameters of group “SDH” are stored;
- "US : Auxiliary outputs", in which the parameters of group "US" are located;
- “SUB: Subcooling”, in which the parameters of group “SUB” are stored;
- "PAL : Alarm parameters", in which the parameters of group "PAL" are located;
- “ET: Electronic Valve”, in which the parameters of group “ET” are stored;
- “RA : Limits of analogue inputs", in which the parameters of group "RA" are located;
- "CA : Calibration of analogue inputs", in which the parameters of group "CA" are located;
- "MS : Multilogic", in which the parameters of group "MS" are located;
- “ENV : Envelope”, in which the parameters of group “ENV” are stored;
- "ACS = Hot Sanitary Water” in which the parameters of the “ACS” unit are stored;
- “FMG: Flowzer”, in which the parameters of group “FMG” are stored;
- “SML: SmartLink+”, in which the parameters of group “SML” are stored;
- “PID: PID parameters”, in which the parameters of group “PID” are stored;

3 SOFTWARE FUNCTIONS

For management of the units, special software is loaded into the controller.

The software consists of a combination of functions dedicated to the conditions in which the units may have to work.

The following chapters describe all the functions managed by the software, from common functions present in all units to functions dedicated to specific operations.

Some of the functions described here may be available only on specific versions or sizes, or according to the selected accessories.

3.1 Set point management

The control set point mainly depends on parameters ST1 and ST4.

The relevant settable minimum and maximum setpoint parameters are shown below.

Parameter	Min.	Max.	UM	Description
ST1	ST2	ST3	°C	Chiller - Setpoint
ST2	-50	ST3	°C	Chiller - Minimum Setpoint
ST3	ST2	110	°C	Chiller - Maximum Setpoint
ST4	ST5	ST6	°C	Heat Pump - Setpoint
ST5	-50	ST6	°C	Heat pump - Minimum Setpoint
ST6	ST5	110	°C	Heat Pump - Maximum Setpoint

There are additional functions that allow an offset to be changed (added or subtracted) at these set point values.

If the Active Set Point in the chiller function is called SA_CHILLER and the Active Set Point in the heat pump function is called SA_HEATPUMP, we obtain:

- SA_CHILLER = ST1 + DynamicSetPoint Offset + Energy_Saving_Offset;
- SA_HEATPUMP = ST4 + DynamicSetPoint Offset + Energy_Saving_Offset.

Even though, in the following descriptions of the various operations, ST1 and ST4 are shown as reference, the controller really uses the actual active set points "SA_CHILLER" and "SA_HEATPUMP".

If the calculated set point in chiller mode is lower than the minimum set point ST2, then SA_CHILLER=ST2. The same applies if the set point is higher than the maximum set point in chiller mode: SA_CHILLER=ST3.

If the calculated set point in heat pump mode is lower than the minimum set point ST5, then SA_ HEATPUMP =ST5. The same applies if the set point is higher than the maximum set point in heat pump mode: SA_HEAT_PUMP=ST6.

3.1.1 Dynamic Set Point

The dynamic set point is a function enabled by the manufacturer.

The reference parameters in managing the dynamic set point are described below.

Parameter	Min	Max	UM	Description
SD1	0	6	-	Dynamic Setpoint type
SD2	0	2	-	States of the unit in which it is active
SD10	0	55	°C	Outside air - Compensation Activation Temperature CH
SD11	0	15	°C	Outdoor temperature - Intervention band compensation in chiller mode
SD12	-10	15	°C	Outdoor temperature - Max increase/decrease setpoint in chiller mode
SD13	-50	110	°C	Dinamic Setpoint probe - Max increase/decrease setpoint in chiller mode
SD14	ST2	ST3	°C	Dinamic setpoint Digital input - Setpoint active with remote digital in chiller mode
SD20	0	55	°C	Outside air - Compensation Activation Temperature HP
SD21	0	15	°C	Outdoor temperature - Intervention band compensation in heat pump mode

Parameter	Min	Max	UM	Description
SD22	-10	15	°C	Outdoor temperature - Max increase/decrease setpoint in heat pump mode
SD23	-50	110	°C	Dinamic Setpoint probe - Max increase/decrease setpoint in heat pump mode
SD24	ST5	ST6	°C	Dinamic setpoint Digital input - Setpoint active with remote digital open in heat pump mode

Depending on parameter SD1, up to 6 types of dynamic set points can be managed:

- from external air probe;
- from 4-20mA signal;
- from 0-1V signal;
- from 0-10V signal;
- from 0-20mA signal;
- from digital input.

3.1.2 Dynamic set point from external air probe

To obtain the set point change from external air probe, it is necessary to have parameter SD1=1.

In chiller operating mode, the parameters involved are shown in the table.

Parameter	Value	UM	Description
ST1	7	°C	Chiller - Setpoint
SD1	1	-	Dynamic Setpoint type
SD10	30	°C	Outside air - Compensation Activation Temperature CH
SD11	5	°C	Outdoor temperature - Intervention band compensation in chiller mode
SD12	5	°C	Outdoor temperature - Max increase/decrease setpoint in chiller mode

With reference to the values set in the table, this corresponds to the graphical representation of the set point change as regards the air temperature value shown in the figure.

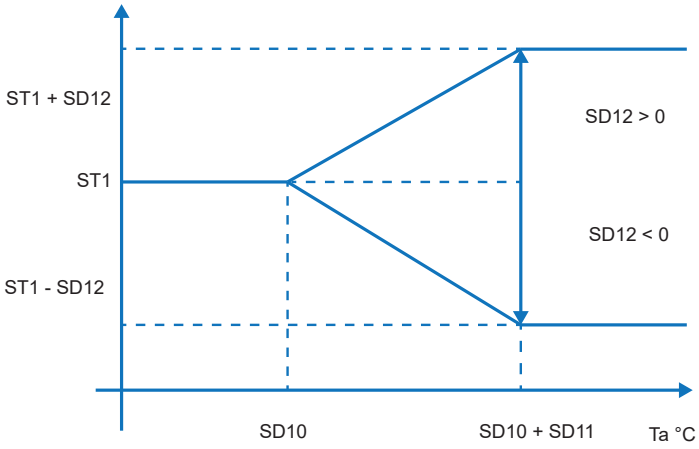


Fig. 2 Change in set point as the air temperature changes in chiller operating mode

Where "Ta" is the value of the outside air temperature.

The following is obtained:

- If the outside air temperature is < SD10, the offset value to add to ST1 is 0;
- If the outside air temperature is > SD10 + SD11, the offset value to add to ST1 is SD12;
- If the outside air temperature is >= SD10 and <= SD10 + SD11, the offset value to add to ST1 can vary between 0 and SD12.

With the values in the table, the set point will be:

- SA_CHILLER = ST1 + 0.0 = 44.0°F;
- SA_CHILLER = ST1 + 9.0 = 54.0°F;
- SA_CHILLER = ST1 + (from 0.0 to 9.0) = from 44.0°F to54.0°F.

In heat pump operating mode, the parameters involved are indicated in the table.

Parameter	Value	UM	Description
ST4	40	°C	Heat Pump - Setpoint
SD1	1	-	Dynamic Setpoint type
SD20	15	°C	Outside air - Compensation Activation Temperature HP
SD21	5	°C	Outdoor temperature - Intervention band compensation in heat pump mode
SD22	5	°C	Outdoor temperature - Max increase/decrease setpoint in heat pump mode

With reference to the values set in the table, this corresponds to the graphical representation of the set point change as regards the air temperature value shown in the figure.

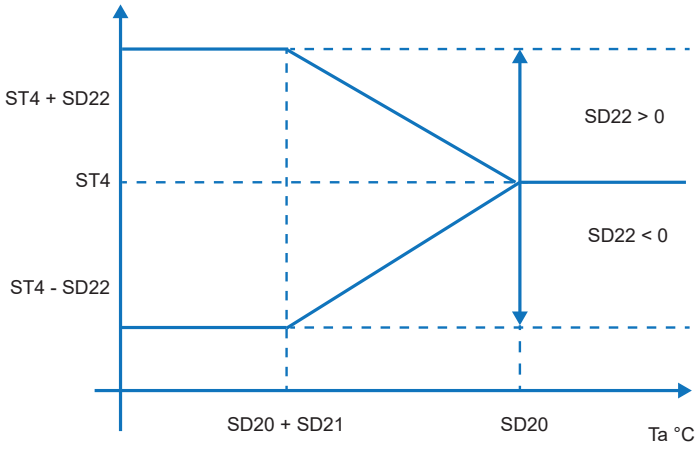


Fig. 3 Change in set point as the air temperature changes in heat pump operating mode

Where "Ta" is the value of the outside air temperature.
The following is obtained:

- If the outside air temperature is > SD20, the offset value to add to ST4 is 0;
- If the outside air temperature is < SD20 - SD21, the offset value to add to ST4 is SD22;
- If the outside air temperature is <= SD20 and >= SD20 - SD21, the offset value to add to ST4 can vary between 0 and SD22.

With the values in the table, the set point will be:

- SA_HEAT_PUMP = ST4 + 0.0 = 40.0°C;
- SA_HEAT_PUMP = ST4 + 5.0 = 45.0°C;
- SA_HEAT_PUMP = ST4 + (from 0.0 to 5.0) = from 40.0°C to 45.0°C.

3.1.3 Dynamic set point from signal

The type of signal used is 4-20mA, 0-1V, 0-10V and 0-20mA.

To obtain the set point change from signal, it is necessary to have parameter SD1=2/3/4/5 respectively for the 4 types of signal.

In chiller operating mode, the parameters involved are shown in the table.

Parameter	Value	UM	Description
ST1	7	°C	Chiller - Setpoint
SD1	4	-	Dynamic Setpoint type
SD13	5	°C	Dinamic Setpoint probe - Max increase/decrease setpoint in chiller mode

With reference to the values set in the table, this corresponds to the graphical representation of the set point change shown in the figure.

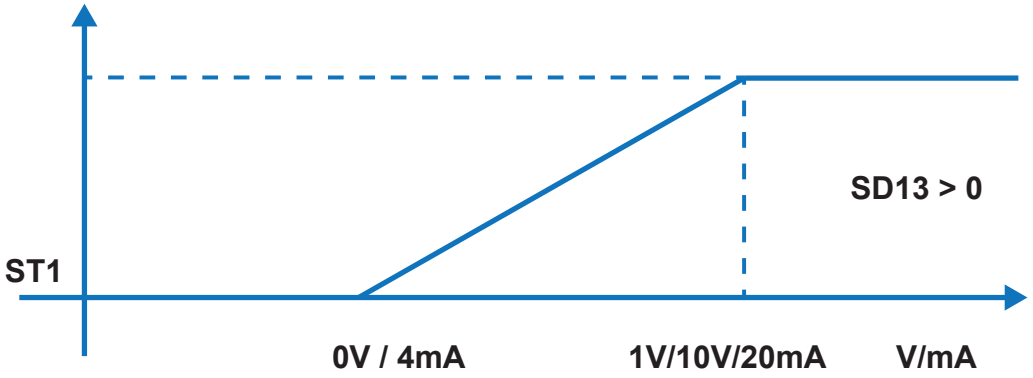


Fig. 4 Change in set point as the analogue signal changes in chiller operating mode

Where "V/mA" is the value of the analogue signal.
The following is obtained:

- If the analogue input reads the signal at the minimum value (0V), the offset value to add to ST1 is 0;
- If the analogue input reads the signal at the maximum value (10V), the offset value to add to ST1 is SD13;
- If the analogue input reads the signal between the minimum and maximum value (0-10V), the offset value to add to ST1 can vary from 0 to SD13.

With the values in the table, the set point will be:

- SA_CHILLER = ST1 + 0.0 = 7.0°C;
- SA_CHILLER = ST1 + 5.0 = 12.0°C;
- SA_CHILLER = ST1 + (from 0.0 to 5.0) = from 7.0°C to 12.0°C.

In heat pump operating mode, the parameters involved are indicated in the table.

Parameter	Value	UM	Description
ST4	40	°C	Heat Pump - Setpoint
SD1	4	-	Dynamic Setpoint type
SD23	5	°C	Dinamic Setpoint probe - Max increase/decrease setpoint in heat pump mode

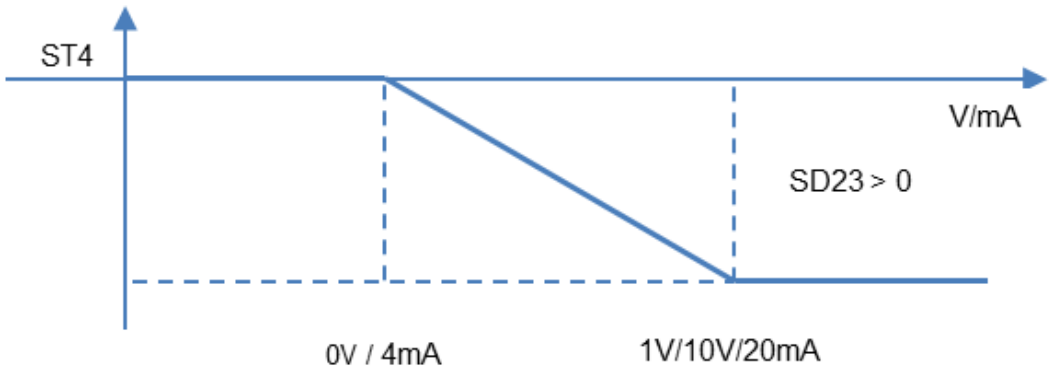


Fig. 5 Change in set point as the analogue signal changes in heat pump operating mode

Where "V/mA" is the value of the analogue signal.
The following is obtained:

- If the analogue input reads the signal at the minimum value (0V), the offset value to subtract from ST4 is 0;
- If the analogue input reads the signal at the maximum value (10V), the offset value to subtract from ST4 is SD23;
- If the analogue input reads the signal between the minimum and maximum value (0-10V), the offset value to subtract from ST4 can vary from 0 to SD23.

With the values in the table, the set point will be:

- SA_HEAT_PUMP = ST4 - 0.0 = 40.0°C;
- SA_HEAT_PUMP = ST4 - 5.0 = 35.0°C;
- SA_HEAT_PUMP = ST4 - (from 0.0 to 5.0) = from 40.0°C to 35.0°C.

3.1.4 Dynamic set point from digital input (dual set point)

To obtain the set point change from digital input, it is necessary to have parameter SD1=6.

The parameters involved in chiller and heat pump operation are shown in the table.

Parameter	Value	UM	Description
ST1	7	°C	Chiller - Setpoint
ST4	40	°C	Heat Pump - Setpoint
SD1	6	-	Dynamic Setpoint type
SD14	12	°C	Dinamic setpoint Digital input - Setpoint active with remote digital in chiller mode
SD24	45	°C	Dinamic setpoint Digital input - Setpoint active with remote digital open in heat pump mode

When the digital input dedicated to this function is closed, the change to the second set point takes place. With the values in the table, the set point will be:

- In chiller operating mode, with digital input open SA_CHILLER = ST1 = 7.0°C;
- In chiller operating mode, with digital input closed SA_CHILLER = SD14 = 12.0°C;
- In heat pump operating mode, with digital input open SA_HEAT PUMP = ST4 = 40.0°C;
- In heat pump operating mode, with digital input closed SA_HEAT PUMP = SD24 = 45.0°C.

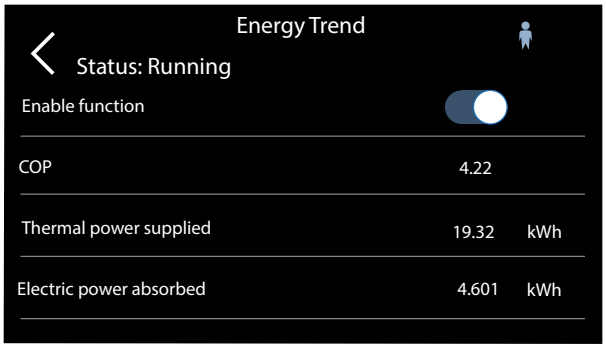
3.2 Energy Trend

3.2.1 Function on the display

The function “Energy trend” is featured on units as an option.

This function estimates the unit operational efficiency (“EER” when operating in cooling mode or “COP” when operating in heating mode) as the current operating conditions and the set parameters change.

Access to the data estimated by the function is gained from the user menu by scrolling the screens until you find the “ENERGY TREND” function and select it.



The “EER” or “COP” values and the delivered and absorbed power values used for the calculation are not measured, but only estimated using models referred to unit operation.

The direct measurement of these values may be different from the values displayed in the controller screen.

The function is only active after a long enough time has elapsed for parameter stabilization within the intended unit operating range and it is updated as these values change.

In special cases of unit operation, such as free cooling, heat recovery, use of a supplementary source and production of domestic hot water (“ACS” function), the efficiency estimation process is suspended and the controller resets the values to zero.

The purpose of this function is to give the user information as required to optimise unit use.

Whenever efficiency reduction is checked over a prolonged period of time, a message is output to warn the user about the need, if any, to perform unscheduled maintenance.

3.2.2 Logs

The measured operating values are not only viewed on the display, but they are also recorded in the controller memory over time.

The values are recorded in the “logs”.

“EnergyTrendHours” is used to record the values concerning the energy absorbed and generated on an hourly basis, and the number of minutes the unit has been in operation every hour.

“EnergyTrendHistory” is used to record the values concerning the energy absorbed and generated on a daily basis, and the number of hours the unit has been in operation every day.

The “logs” can be downloaded from a USB pen drive or the WEB pages. These are “.txt” text files that can be easily added to a spreadsheet.

In the files, an initial line shows the acronyms that identify the values recorded in each column.

The values recorded are whole numbers. The value may in some cases need to be divided by 100 in order for it to match the unit of measurement.

The tables below are useful to interpret the values stored in the “logs”.

File "EnergyTrendHours.txt"

Reference	Description	U of M	(*)k
DATE_TIME	Date and time, expressed as yyyymmddhh		1
EN_IN_CH	Energy absorbed on an hourly basis in chiller mode	[kWh]	100
EN_OUT_CH	Energy generated on an hourly basis in chiller mode	[kWh]	100
EER_AVG	Average hourly EER		100
EN_IN_HP	Energy absorbed on an hourly basis in heat pump mode	[kWh]	100
EN_OUT_HP	Energy generated on an hourly basis in heat pump mode	[kWh]	100
COP_AVG	Average daily COP		100
EN_IN_DHW	Energy absorbed on an hourly basis in ACS mode	[kWh]	100
EN_OUT_DHW	Energy generated on an hourly basis in ACS mode	[kWh]	100
COP_AVG	Average hourly COP for ACS		100
MIN_CH	Minutes of operation in chiller mode	[min]	1
MIN _HP	Minutes of operation in heat pump mode	[min]	1
MIN _DHW	Minutes of operation in ACS mode	[min]	1
MIN _OUT_OF_SIM	Minutes in which unit operation could not be simulated	[min]	1

(*) k = conversion coefficient by which the values in the column are divided

Each line is referred to an hour of operation.

The columns “minutes of operation” show the minutes within the hour in which the function was active.

The values are entered in the history log at minute “00” of each hour in the day.

In the event of a power failure to the unit, the data recorded in the hour are lost.

The calculation of the EER and COP values is not managed in “domestic hot water”mode - the corresponding columns are always “0”, and the hours of operation are counted.

File "EnergyTrendHistory.txt"

Reference	Description	U.M
DATE	Date type yyyymmdd	
EN_IN_CH	Energy absorbed on a daily basis in chiller mode	[kWh]
EN_OUT_CH	Energy generated on a daily basis in chiller mode	[kWh]
EER_AVG	Average daily EER	
EN_IN_HP	Energy absorbed on a daily basis in heat pump mode	[kWh]
EN_OUT_HP	Energy generated on a daily basis in heat pump mode	[kWh]
COP_AVG	Average daily COP	
EN_IN_DHW	Energy absorbed on a daily basis in ACS mode	[kWh]
EN_OUT_DHW	Energy generated on a daily basis in ACS mode	[kWh]
COP_AVG	Average daily COP for ACS	
H_CH	Daily hours of operation in chiller mode	[h]
H_HP	Daily hours of operation in heat pump mode	[h]
H_DHW	Daily hours of operation in ACS mode	[h]
H_OUT_OF_SIM	Daily hours in which unit operation could not be simulated	[h]

The values in all columns except for the “DATE” column must be divided by 100.
Each line is referred to a day of operation.

The columns “hours of operation” show the hours within the day in which the function was active.

The values are entered in the history log at “00:00” each day.

In the event of a power failure to the unit, the data recorded in the hour are lost.

The calculation of the EER and COP values is not managed in “domestic hot water”mode - the corresponding columns are always “0”, and the hours of operation are counted.

3.3 Smart Grid ready

The two digital inputs provided help override thermoregulation to operation in hot mode. This function does not trigger when thermoregulation is operating in cold mode.

Units are always provided with this function although it is not enabled.

When the function is enabled, the status of the two featured digital inputs combined activates the 4 operating modes listed in the table.

Operating mode	Status DI1	Status DI2	Description
1	Closed	Open	Thermoregulation in hot mode is disabled for as long as the condition persists, but in any case the max. time set in parameter “AH18” is never exceeded.
2	Open	Open	Thermoregulation follows the demand of the stored operating setpoint.
3	Open	Closed	Thermoregulation follows the demand of dedicated “setpoint 1”.
4	Closed	Closed	Thermoregulation follows the demand of dedicated “setpoint 2”.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
SP21	0	2	-	Smart Grid Enable 0 = disabled 1 = enabled without supplementary source 2 = enabled with supplementary source
AH18	1	999	min.	Maximum override time to OFF
AH19	ST5	ST6	°C	Setpoint1 in operating mode 3
AH20	ST5	ST6	°C	Setpoint2 in operating mode 4

The value in parameter “SP21” is set to “0” (function disabled) in the factory. The value in parameter “AH18” is set to 120 minutes.

The values in parameters “AH19” and “AH20” are set with the same value as parameter “ST4”.

The installer is responsible for enabling the function and setting up suitable values for operation.

3.3.1 Enable

All water heating units are configured to manage this function.

The units are shipped from the factory with the function disabled via software.

The function is enabled using parameter “SP21”.

When the function is enabled, the operation of the digital inputs in the terminal board is active. The wiring diagram shows the involved terminals.

All units are configured to manage this function.

The units are shipped from the factory with the function disabled via software.

The function is enabled using parameter “SP21”.

When the function is enabled, the operation of the digital inputs in the terminal board is active. The wiring diagram shows the involved terminals.

3.3.2 Operating mode 1

Activation of this operating mode requires that digital input “1” is closed and output “2” is open. After mode activation, the controller stops thermoregulation in hot mode as long as the condition persists; in any case the time setpoint value stored in parameter “AH18” is never exceeded.

If the status of the digital inputs does not change and consequently the operating mode fails to change, the controller will restart normal thermoregulation operation in hot mode after the time set in parameter “AH18” has elapsed.

As soon as normal operation is restored, a change in the digital input status is required for the next stop.

If the “ACS” function is featured, this operating mode stops it.

If a seasonal mode change occurs during operation in heating mode or where the “ACS” function is enabled in cooling mode, the unit performs thermoregulation in cooling mode.

The cold circuit continues operating according to the demand received from its thermoregulation.

A stop of cold mode operation or of the entire unit causes resetting of the time count set with the value of parameter “AH18”.

At the next restarting of cold mode or of the entire unit, if the condition persists, the stop override starts from the beginning.

3.3.3 Operating mode 2

Activation of this operating mode requires that both digital input “1” and “2” are open. When it is activated, the controller controls thermoregulation in hot mode following the active operating setpoint.

This combination of digital inputs prevents the “Smart Grid Ready” from having an impact on unit operation.

3.3.4 Operating mode 3

Activation of this operating mode requires that digital input “1” is open and output “2” is closed.

When it is activated, the controller overrides thermoregulation in heating mode to “setpoint1” which is set with the value in parameter “AH19”.

This setpoint value prioritises all the settings that are used to control the variation of the operating setpoint.

If the unit is operating in cooling mode, the override process is ignored.

The override process may at all times be stopped by stopping the unit.

When it is activated, the controller overrides thermoregulation in hot mode to “setpoint1” which is set with the value in parameter “AH19”.

This setpoint value prioritises all the settings that are used to control the variation of the operating setpoint.

The override process is stopped when operation in hot mode or the unit is stopped.

If the production of hot water is not active when “setpoint1” is overridden, the function is ignored.

3.3.5 Operating mode 4

Activation of this operating mode requires that digital input “1” and “2” are closed.

If thermoregulation in hot mode was not active when “setpoint2” was overridden, the function will be ignored.

When it is activated, the controller overrides thermoregulation in heating mode to “setpoint2” which is set with the value in parameter “AH20”.

When parameter “SP21” is set to “2” in this operating mode, the supplementary sources fitted in the unit are started without taking into account the outside air temperature threshold “AH2”.

This setpoint value prioritises all the settings that are used to control the variation of the operating setpoint.

If the unit is operating in cooling mode, the override process is ignored.

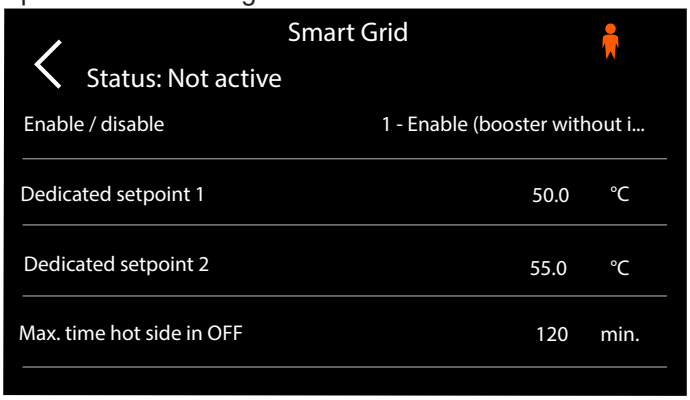
The override process may at all times be stopped by stopping the unit.

3.3.6 References on user interface

The function can be managed using the parameters described above or using the user interface.

After accessing the password-protected menus with a “Service” or “Maintenance” profile, access to the screen featuring the “Smart Grid ready” function is gained using the right-hand arrow.

Select the “Smart Grid ready” function to access the screen where the function is enabled: select the two setpoints and the maximum stop time for hot water production following an override.



If the acronym “SG1” or “SG2” appears in the main screen, the setpoint displayed is the setpoint connected to the status of the digital inputs of the function.

If the unit is not operational, a click on the “On-Off” icon in the main screen helps check if it is in “overridden switch-off” status due to the “Smart Grid ready” function.

3.4 Thermoregulation

The thermoregulation of the unit depends on parameter ST9 that determines on which temperature probe the controller must guarantee maintenance of the temperature set as the set point, and on parameter ST11 that determines the type of control.

With the combination of settings, it is possible to have:

- ST9 = 0 and ST11 = 0 - proportional input registration;
- ST9 = 5 and ST11 = 1 - output registration with neutral zone and PID;
- ST9 = 5 and ST11 = 2 - output registration with neutral zone and PID for units featuring inverter compressors;

3.4.1 Proportional inlet control

The parameters involved in proportional thermoregulation on evaporator inlet probe are shown below.

Parameter	Min	Max	UM	Description
ST1	ST2	ST3	°C	Chiller - Setpoint
ST2	-50	ST3	°C	Chiller - Minimum Setpoint
ST3	ST2	110	°C	Chiller - Maximum Setpoint
ST4	ST5	ST6	°C	Heat Pump - Setpoint
ST5	-50	ST6	°C	Heat pump - Minimum Setpoint
ST6	ST5	110	°C	Heat Pump - Maximum Setpoint
ST7	0.1	25.5	°C	Chiller - Proportional control band
ST8	0.1	25.5	°C	Heat pump - Proportional control band

3.4.2 Outlet control with neutral zone and PID

The reference probe is placed on the common outlet of the evaporator. The resources (compressors) are activated/deactivated depending on a set point and a differential, complying with the reference delays.

Parameter	Min.	Max.	UM	Description
ST1	ST2	ST3	°C	Chiller - Setpoint
ST2	-50	ST3	°C	Chiller - Minimum Setpoint
ST3	ST3	50°C	°C	Chiller - Maximum Setpoint
ST4	ST5	ST6	°C	Heat Pump - Setpoint
ST5	-50	ST5	°C	Heat pump - Minimum Setpoint
ST6	ST5	999	°C	Heat Pump - Maximum Setpoint
ST18	0.1	25.5	°C	With NZ or PID, Chiller - Activation zone offset
ST19	0.1	25.5	°C	With NZ or PID, Heat Pump - Activation zone offset
ST20	0.1	25.5	°C	With NZ or PID, Chiller - De-activation zone offset
ST21	0.1	25.5	°C	With NZ or PID, Heat Pump - De-activation zone offset
ST22	ST23	999	Sec	With ZN or PID, Chiller - Maximum activation time
ST23	0	ST22	Sec	With NZ or PID, Chiller - Min. activation time
ST24	ST25	999	Sec	With ZN or PID, Chiller - Maximum de-activation time
ST25	0	ST24	Sec	With NZ or PID, Chiller - Min. de-activation time
ST26	ST27	999	Sec	With ZN or PID, Heat pump - Maximum activation time
ST27	0	ST26	Sec	With NZ or PID, Heat Pump - Minimum activation time
ST28	ST29	999	Sec	With ZN or PID, Heat Pump - Maximum de-activation time
ST29	0	ST28	Sec	With ZN or PID, Heat pump - Minimum de-activation time
ST30	0.1	25.5	°C	With NZ or PID, Chiller - Neutral zone band
ST31	0.1	25.5	°C	With NZ or PID, Heat Pump - Neutral zone band
ST32	-50	110	°C	Limit threshold for operation in chiller mode (prevention)

Example of control with neutral zone in chiller mode

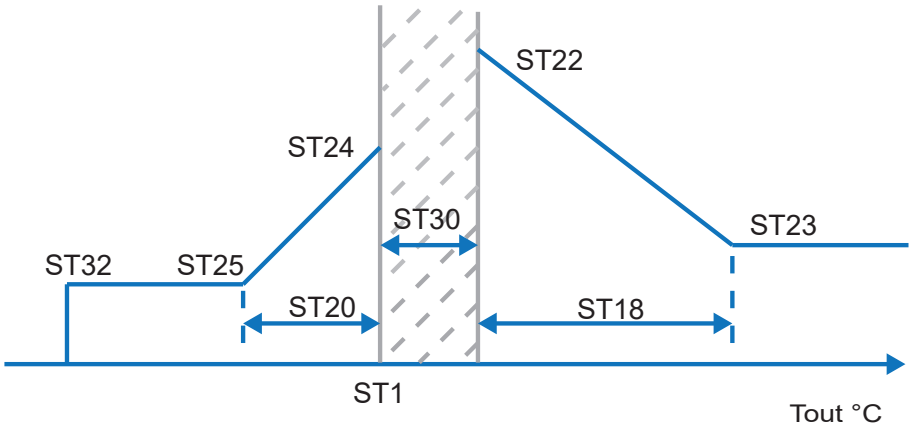


Fig. 6 Graphical representation of operation in chiller mode and outlet control

As long as the reference water temperature is more than (>) ST1 + ST30, the compressors of the unit will be activated complying with the delays included in parameters ST22 and ST23.

If the water temperature is included in the values that determine the neutral zone, the compressors will be activated only if at least one compressors of the unit is already on.

If the reference temperature is less than (<) ST1 and more than (>) ST1 – ST20, then the capacity of the compressors is progressively reduced and the compressors are progressively deactivated complying with the delays included in parameters ST24 and ST25.

If the temperature is < ST32, the compressors are switched off immediately. In this case, no alarm signal is shown.

Example of control with neutral zone in heat pump mode

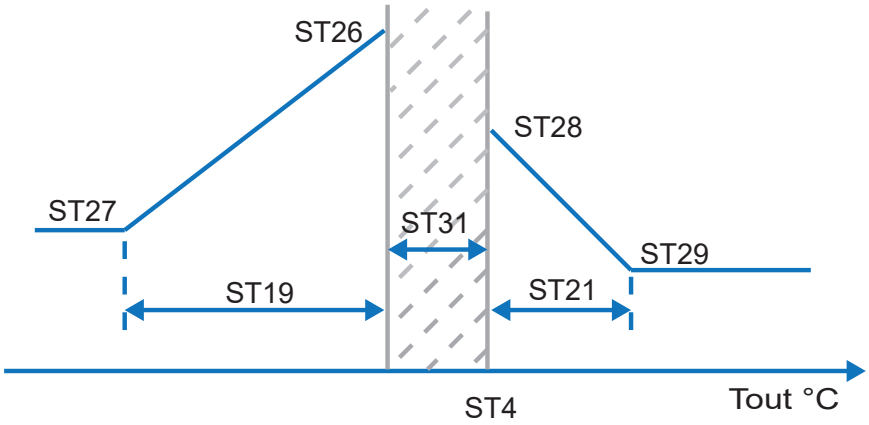


Fig. 7 Graphical representation of operation in heat pump mode and outlet control

As long as the reference water temperature is less than (<) ST4 - ST31, the compressors of the unit will be activated complying with the delays included in parameters ST27 and ST26.

If the water temperature is included in the values that determine the neutral zone, the compressors will be activated only if at least one compressors of the unit is already on.

If the reference temperature is more than (>) ST4 and less than (<) ST4 + ST21, then the capacity of the compressors is progressively reduced and the compressors are progressively deactivated complying with the delays included in parameters ST28 and ST29.

3.5 Limitation of refrigeration capacity

There are some operating conditions for which the refrigeration capacity of the unit can be limited automatically or necessarily.

Limitation can be done in 4 different ways:

- from pressure probe (always present)
- from amperometric transformer (accessory)
- from digital input (accessory);
- from BMS.

All the parameters involved with this function are shown in the table.

Parameter	Min	Max	UM	Description
UN1	0	1	-	Unloading from digital input
UN2	0	1	-	Unloading from Supervision
UN3	0	1	-	Unloading from low/high pressure transducer
UN4	0	1	-	Unloading from Amperometric Transformer
UN5	0.0	99.9	bar	High pressure - Unloading Setpoint in chiller mode
UN6	0.0	25.5	bar	High pressure - Unloading differential in chiller mode
UN7	0.0	99.9	bar	High pressure - Unloading Setpoint in heat pump mode
UN8	0.0	25.5	bar	High pressure - Unloading differential in heat pump mode
UN9	0.0	99.9	bar	Low pressure - Unloading Setpoint in chiller mode
UN10	0.1	25.5	bar	Low pressure - Unloading differential in chiller mode
UN11	0.0	99.9	bar	Low pressure - Unloading Setpoint in heat pump mode
UN12	0.1	25.5	bar	Low pressure - Unloading differential in heat pump mode
UN13	0	100	%	Max. percentage circuit limit with capacity reduction
UN14	0	100	%	Inverter scroll - Unloading Percentage
UN17	0	999	min	Capacity reduction activation time limit
UN18	0	999	min	Time between two capacity reductions of the same circuit
UN19	0	500	A	Minimum full-scale value of 4mA current probe
UN20	50	1000	A	Maximum full-scale value of 20mA current probe
UN21	10	1000	A	Current capacity reduction threshold
UN22	0	500	A	Current capacity reduction differential
ST13	0	100	%	Unit capacity limit (On/Off compressors and inverter)
ST23	0	60	s	With NZ or PID, Chiller - Min. activation time
ST25	0	60	s	With NZ or PID, Chiller - Min. de-activation time

3.5.1 Limitation of refrigeration capacity from pressure probe

In some operating situations of the unit (too high condensing pressures or too low evaporating pressures) it may be useful to limit the capacity of the compressor.

The parameters involved in limitation of refrigeration capacity with reference to condensing pressure are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN3	1	-	Unloading from low/high pressure transducer
UN5	39.0	Bar	High pressure - Unloading Setpoint in chiller mode
UN6	3.0	Bar	High pressure - Unloading differential in chiller mode
UN7	39.0	Bar	High pressure - Unloading Setpoint in heat pump mode
UN8	5.0	Bar	High pressure - Unloading differential in heat pump mode
UN13	30	%	Max. percentage circuit limit with capacity reduction
UN14	65	%	Inverter scroll - Unloading Percentage
UN17	2	Min	Capacity reduction activation time limit
UN18	2	Min	Time between two capacity reductions of the same circuit

Activation of capacity reduction in the circuit takes place when the following conditions are verified:

- in chiller operating mode, when the condensing pressure is higher than UN5;
- in heat pump operating mode, when the condensing pressure is higher than UN7;

Deactivation of capacity reduction in the circuit takes place when the following conditions are verified:

- in chiller operating mode, when the condensing pressure is lower than UN5 - UN6;
- in heat pump operating mode, when the condensing pressure is lower than UN7 - UN8.

The parameters involved in limitation of refrigeration capacity with reference to evaporating pressure are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN3	1	-	Unloading from low/high pressure transducer
UN9	4.5	Bar	Low pressure - Unloading Setpoint in chiller mode
UN10	1.0	Bar	Low pressure - Unloading differential in chiller mode
UN11	2.5	Bar	Low pressure - Unloading Setpoint in heat pump mode
UN12	1.0	Bar	Low pressure - Unloading differential in heat pump mode
UN13	30	%	Max. percentage circuit limit with capacity reduction
UN14	65	%	Inverter scroll - Unloading Percentage
UN17	2	Min	Capacity reduction activation time limit
UN18	2	Min	Time between two capacity reductions of the same circuit

Activation of capacity reduction in the circuit takes place when the following conditions are verified:

- in chiller operating mode, when the evaporating pressure is lower than UN9;
- in heat pump operating mode, when the evaporating pressure is lower than UN11.

Deactivation of capacity reduction in the circuit takes place when the following conditions are verified:

- in chiller operating mode, when the evaporating pressure is higher than UN9 + UN10;
- in heat pump operating mode, when the evaporating pressure is higher than UN11 + UN12;

Cooling capacity limitation in units with several steps per circuit depends on the value set in parameter “UN13”.

The controller uses the percentage set in parameter “UN13” to calculate the number of steps to activate in the circuit.

The value of parameter “UN13” refers to the operating percentage (0 = the whole circuit deactivated; 100 = no capacity reduction).

3.5.2 Limitation of refrigeration capacity from digital input

Limitation of refrigeration capacity can be carried out from digital input.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN1	1	-	Unloading from digital input
ST13	30	%	Unit capacity limit (On/Off compressors and inverter)

Cooling capacity limitation in units with several steps per circuit depends on the value set in parameter “ST13”.

The controller uses the percentage set in parameter “ST13” to calculate the number of steps to activate in the circuit.

The value of parameter “ST13” refers to the operating percentage (0 = the whole circuit deactivated; 100 = no capacity reduction).

Forcing of capacity reduction can continue indefinitely.

3.5.3 Limitation of refrigeration capacity from BMS

Limitation of refrigeration capacity can be carried out from BMS.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN2	1	-	Unloading from Supervision
ST13	30	%	Unit capacity limit (On/Off compressors and inverter)
SP6	1	-	Enable BMS supervision writings

To enable capacity reduction from BMS, parameter SP6 must also be enabled.

The variable (Capacity Limit) that enables the function is shown below.

Group	Type	Addr.	Description
Capacity Limit	3	11246	0 = OFF; 1 = ON

Cooling capacity limitation in units with several steps per circuit depends on the value written on the BMS variable and it is limited to the setpoint in parameter “ST13”.

The controller uses the percentage of the BMS variable to calculate the number of steps to be activated in the unit.

The value of parameter “ST13” refers to the operating percentage (0 = unit deactivated; 100 = no capacity reduction).

Forcing of capacity reduction can continue indefinitely.

3.6 Circuits and compressors

To meet the thermoregulation request from the system, the controller activates and deactivates the compressors of the circuits present in the unit as required.

The management of individual compressors, and also of the combination of compressors, takes place according to the setting of the relevant parameters.

All the parameters involved in these management methods are shown in the table.

Parameter	Min	Max	UM	Description
CO1	0	999	s	Minimum ON time
CO2	0	999	s	Minimum OFF time
CO3	0	999	10 s	Minimum time between 2 activations of the same compressor
CO7	0	999	s	Delay for activation of loads on unit switch-on (pumps, compressors)

3.6.1 Starting and stopping of the compressors

Except in particular conditions, the compressors are started and stopped following a precise procedure.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO1	300	s	Minimum ON time
CO2	300	s	Minimum OFF time
CO3	90	10 s	Minimum time between 2 activations of the same compressor
CO7	25	s	Delay for activation of loads on unit switch-on (pumps, compressors)

After the unit has started, even though there is a thermoregulation request, the controller ensures compliance with the minimum OFF time of the compressors.

The graph for the actual thermoregulation request and the respective switch-ons and switch-offs is shown below.

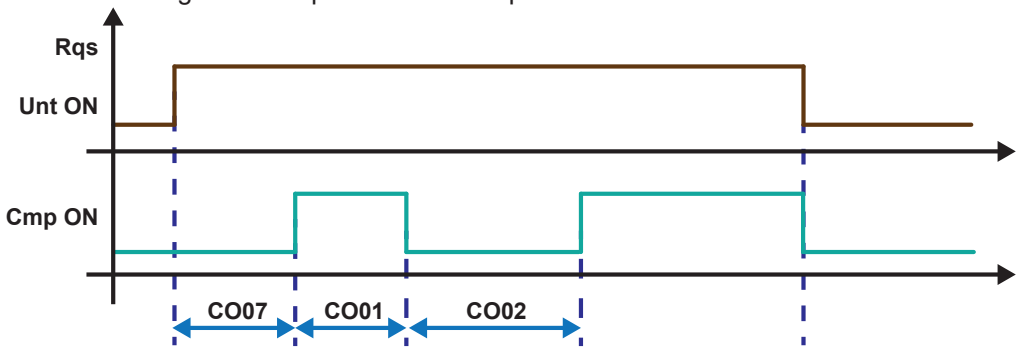


Fig. 8 Compressor control

In the graph, beside the parameters of the function, there are the abbreviations that refer to:

- Rqs = thermoregulation request
- Unt ON = reference to unit
- Cmp ON = reference to compressor

3.6.2 Management of compressor with inverter

The controller includes inverter management on chiller and heat pump units.

Thermoregulation in units featuring inverter compressors is checked with reference to the output water temperature from the unit, including a neutral area and the PID (ST9 = 5 and ST11 = 2).

The operating parameters of the inverter in the compressor are displayed in the second screen of the “Refrigerant circuit” menu by clicking the “Graph” icon, as shown in the figure below.

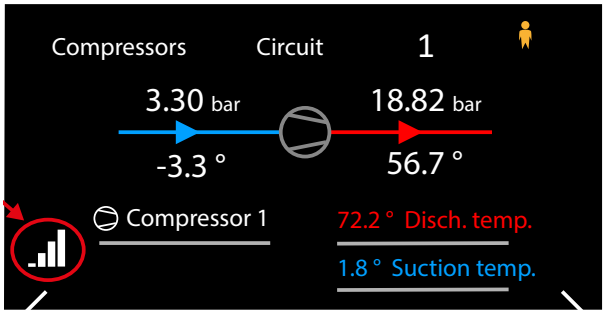


Fig. 9 Second screen in “Refrigerant circuit” menu

Operation of the compressor with inverter follows the thermoregulation request by means of a PID algorithm. A factor indicating the capacity required by the system, called count, is then generated by the controller.

The parameters involved are shown in the table.

Parameter	Min.	Max.	UM	Description
ST1	ST2	ST3	°C	Chiller - Setpoint
ST4	ST5	ST6	°C	Heat Pump - Setpoint
ST30	0,1	25.5	°C	With NZ or PID, Chiller - Neutral zone band
ST31	0,1	25.5	°C	With NZ or PID, Heat Pump - Neutral zone band
CO36	1	100	-	Inverter - Decrase/incrase power step Termoregolation
CO38	CO40	100	%	Inverter - Maximum speed inverter
CO40	0	CO38	%	Inverter - Minimum speed inverter

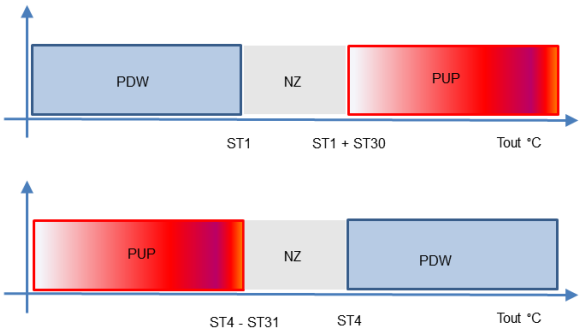


Fig. 10 Representation of the areas of operation in chiller and heat pump mode

where

PDW = Deactivation zone

NZ = Neutral zone

PUP = Activation zone

In the activation zone, the count increases with the times indicated in the thermoregulation chapter. Calculation of the count involves parameter CO36.

The values of the parameters are representative. In specific cases, different values can be set.

Activation zone	Count = Count + CO36
Neutral zone	Count = Count + CO36
Deactivation zone	Count = Count - CO36

3.6.3 Thermoregulation of units with inverter

When the capacity is calculated based on the thermoregulation demand, the controller manages the compressor with inverter.

The controller starts the count after complying with the delays from the starting of the unit and of the pump, if any.

The graphic representation below shows how the controller manages starting of the compressor with inverter when the capacity required by thermoregulation increases.

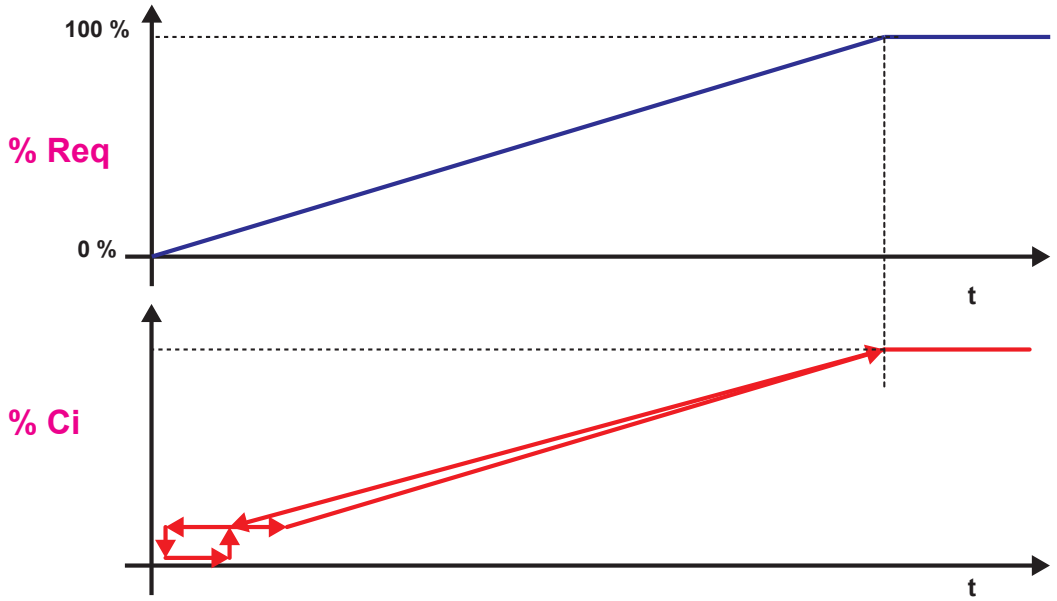


Fig. 11 Graph showing starting of the compressor with inverter

The abbreviations of the graph indicate:

- %Req = percentage capacity demanded by thermoregulation
- %Ci = percentage coefficient demand to inverter compressor
- t = time.

The percentage operating frequency of the compressor follows the percentage demand, excepting at start-up and stop in min. frequency operating conditions, as set in parameter “CO40”.

3.7 Ventilation

The controller provides for the management of step ventilation or in continuous mode with modulation of the 0-10V signal.

The stepped control can have up to 4 steps per circuit with relevant 4 digital outputs. With control in continuous mode, for each circuit there is a digital output for activation of ventilation and an analogue output with modulating circuit for control of a speed adjuster.

The stepped management is limited to the units for which it is intended.

Ventilation of the unit is controlled by the FA parameters. The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
FA1	1	4	-	Type of ventilation control
FA2	0	1	-	Ventilation operating mode
FA3	0	999	s	Ventilation Speed Up at start
FA5	0	999	s	Chiller - Pre-ventilation time before compressor start-up
FA6	0	100	%	Chiller - Min. speed
FA7	30	100	%	Chiller - Max. speed
FA8	-50.0	110.0	°C	Chiller - Condensation setpoint for min. speed
FA9	-50.0	110.0	°C	Chiller - Condensing temperature for max. speed
FA11	0.1	25.5	°C	Chiller - Cut-off differential
FA12	0.1	25.5	°C	Chiller - Cut-off override
FA13	0	999	s	CUT-OFF delay
FA14	0	100	%	Heat pump - Minimum speed
FA15	30	100	%	Heat pump - Maximum speed
FA16	-50.0	110.0	°C	Heat pump - Evaporation temperature for minimum speed
FA17	-50.0	110.0	°C	Heat pump - Evaporation temperature for maximum speed
FA18	0	100	%	Fixed ventilation speed during defrost cycle
FA19	0.1	25.5	°C	Heat pump - Cut-off differential
FA20	0.1	25.5	°C	Heat pump - Cut-off override
FA21	-30.0	50.0	°C	Fan stop prevention function - Activation threshold
FA22	0	9999	min	Fan stop prevention function - Time between cycles (0 = disabled)
FA23	0	9999	s	Fan stop prevention function - Operating time
FA27	0	1	-	Enable fan speed optimisation on circuit capacity
FA29	0	1	-	Night shift - Enables function (only chiller mode)
FA30	0.0	50.0	°C	Night shift - Temperature differential at min. speed in chiller mode
FA31	0.0	50.0	°C	Night shift - Temperature differential at max. speed in chiller mode
FA32	00:00	24:00	hr	Night shift - Start of time band (0÷ 24)
FA33	00:00	24:00	hr	Night shift - End of time band (0÷ 24)
FA34	0	1	-	Night shift - Enable on Monday
FA35	0	1	-	Night shift - Enable on Tuesday
FA36	0	1	-	Night shift - Enable on Wednesday
FA37	0	1	-	Night shift - Enable on Thursday
FA38	0	1	-	Night shift - Enable on Friday
FA39	0	1	-	Night shift - Enable on Saturday
FA40	0	1	-	Night shift - Enable on Sunday
FA48	0.0	110.0	°C	Chiller - Max. condensing temperature limit
PAL80	0	999	s	Fan overload - delay alarm
PAL81	0	60	-	Fan overload - Maximun number alarms in one hours

3.7.1 Ventilation

The parameter “FA4” is set to “0”.

The controller fulfils the condensing temperatures when operating in chiller mode and the evaporating temperatures when operating in heat pump mode.

Only one digital input is featured for all ventilation-related safety devices.

3.7.2 Ventilation management with speed adjuster

With speed adjuster, ventilation is managed in continuous mode.

For each refrigerant circuit, there is a digital output for activation of ventilation and an analogue output with modulating circuit for control of a speed adjuster.

The parameters involved in the chiller operating mode are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FA1	4	-	Type of ventilation control
FA2	0	-	Ventilation operating mode
FA3	2	s	Ventilation Speed Up at start
FA5	0	s	Chiller - Pre-ventilation time before compressor start-up
FA6	30	%	Chiller - Min. speed
FA7	100	%	Chiller - Max. speed
FA8	32.0	°C	Chiller - Condensation setpoint for min. speed
FA9	50.0	°C	Chiller - Condensing temperature for max. speed

The function with relevant parameters is shown graphically below.

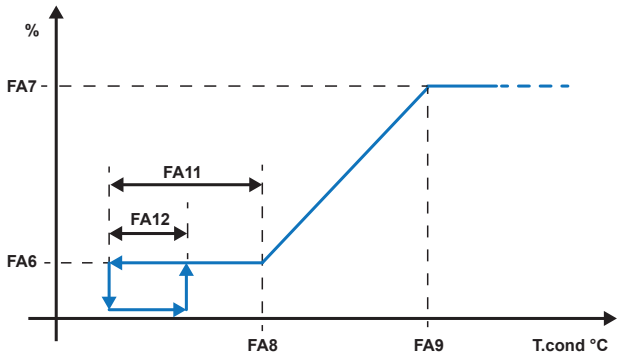


Fig. 12 Analogue output for control of the speed adjuster

The parameters involved in the heat pump operating mode are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FA1	4	-	Type of ventilation control
FA2	0	-	Ventilation operating mode
FA3	2	s	Ventilation Speed Up at start
FA5	0	s	Chiller - Pre-ventilation time before compressor start-up
FA14	30	%	Heat pump - Minimum speed
FA15	100	%	Heat pump - Maximum speed
FA16	12.0	°C	Heat pump - Evaporation temperature for minimum speed
FA17	0.0	°C	Heat pump - Evaporation temperature for maximum speed
FA19	3.0	°C	Heat pump - Cut-off differential
FA20	1.0	°C	Heat pump - Cut-off override

The function with relevant parameters is shown graphically below.

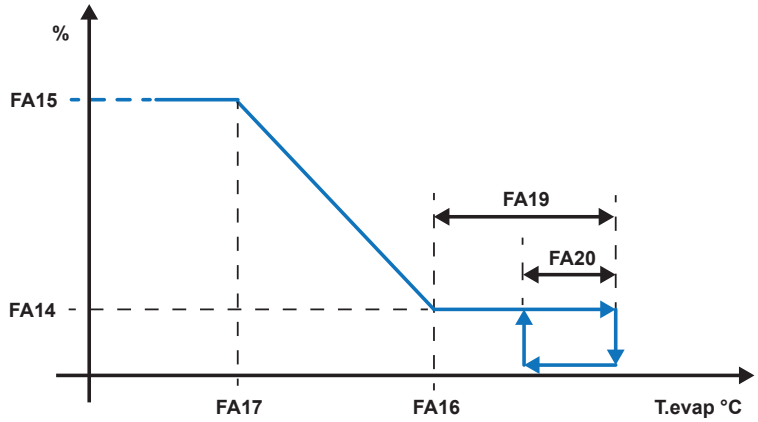


Fig. 13 Analogue output for control of the speed adjuster

In heat pump operating mode, ventilation is activated when the evaporating temperature is lower than FA16 + FA19 - FA20 and is deactivated when the evaporating temperature is higher than FA16 + FA19.When the evaporating temperature is between values FA16 and FA17, the analogue output modulates between the percentages of values FA14 and FA15.

3.7.3 Night Shift System

Through the setting of daily time bands, the additional "Night Shift System" function allows the unit to be operated in high efficiency mode or in low noise mode as required.

The function can be activated only for condensing control and with proportional ventilation control.

The parameters involved in the operation are shown in the table (1 = function active; 0 = function not active).

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FA1	4	-	Type of ventilation control
FA6	30	%	Chiller - Min. speed
FA7	100	%	Chiller - Max. speed
FA8	32.0	°C	Chiller - Condensation setpoint for min. speed
FA9	50.0	°C	Chiller - Condensing temperature for max. speed
FA11	25.5	°C	Chiller - Cut-off differential
FA12	25.5	°C	Chiller - Cut-off override
FA29	1	-	Night shift - Enables function (only chiller mode)
FA30	35.0	°C	Night shift - Temperature differential at min. speed in chiller mode
FA31	60.0	°C	Night shift - Temperature differential at max. speed in chiller mode
FA32	8:30	h	Night shift - Start of time band (0÷ 24)
FA33	14:10	h	Night shift - End of time band (0÷ 24)
FA34	1	-	Night shift - Enable on Monday
FA35	1	-	Night shift - Enable on Tuesday
FA36	1	-	Night shift - Enable on Wednesday
FA37	1	-	Night shift - Enable on Thursday
FA38	1	-	Night shift - Enable on Friday
FA39	0	-	Night shift - Enable on Saturday
FA40	0	-	Night shift - Enable on Sunday
FA48	68.0	°C	Chiller - Max. condensing temperature limit

The function with relevant parameters is shown graphically below.

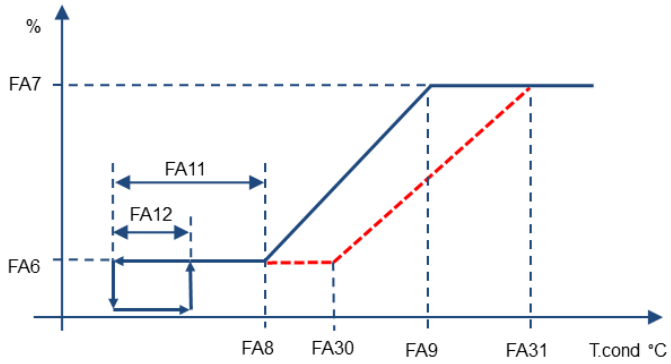


Fig. 14 Analogue output for control of the speed adjuster

In the time bands when the function is active the analogue output for condensation control changes the reference values (“FA8” and “FA9”), i.e. it increases them by the setpoints in parameters “FA30” and “FA31” respectively.

Condensation control takes place at the values resulting from the sum of “FA8” + “FA30” and “FA9” + “FA31”.

The max. limit value of the condensing temperature resulting from the sum “FA9” + “FA31” is in any case limited by the setpoint in parameter “FA48”.

3.8 User-side pumps

Management of the pumps in the unit takes place based on the number of pumps configured.

The application manages the pumps through the setting of the PA parameters. The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
PA1	0	2	-	Users - Pump management
PA2	0	999	10 s	User - Compressor activation delay from pump start-up
PA3	0	999	10 s	Users - Pump Off delay from switch-off of compressors
PA4	0	999	10 s	Users - Pump Off delay from keypad / BMS / remote input switch-off
PA5	0	4	-	Users - Type of rotation of pumps
PA6	0	1	-	Users - Manual reversal of pumps
PA7	0	999	h	Users - Number of hours of pump operation to carry out a rotation
PA8	0	999	s	Users - Period of pumps ON simultaneously after rotation of pumps
PA9	0	2	-	Users - Antifreeze - Action of pumps in case of antifreeze alarm with unit off
PA10	1	5	-	Users - Antifreeze - Selection of antifreeze probe
PA11	-50.0	110.0	°C	Users - Antifreeze - Pump activation threshold on antifreeze probe
PA12	0.1	25.5	°C	Users - Antifreeze - Pump deactivation differential on antifreeze probe
PA13	0	1	-	User - Anti-sticking Enable anti-sticking function
PA14	0	999	s	Users - Pulse - Pump switch-off delay
PA15	0	999	m	Users - Pulse - Interval of time in which the pump is on with compressors off
PA16	0	999	m	Users - Pulse - Interval of time in which the pump is off with compressors off
PA17	0	999	m	Users - Pump shutdown delay by remote digital input
PA18	0	9999	10 h	Users - Threshold Hour meter pumps
PA39	0	999	s	Users - Delay for pump activation from permission for valve opening
PA40	0	999	s	Off time of pumps during rotation (VFPP)
PA42	0	999	s	Users - Delay for valve closing from pump deactivation
PA49	0	1	-	User - Enabling pumps rotation only with compressors off

Parameter PA1 determines the way in which the controller manages the pumps and therefore water circulation in the unit:

- 0 = Water circulation in the unit is not managed;
- 1 = Activation of water circulation (activation of a pump) follows activation of the unit;
- 2 = Activation of water circulation (activation of a pump), follows the status of the compressors and therefore the thermoregulation request.

If parameter PA1 = 2 (activation of water circulation follows thermoregulation) management of water circulation depends on parameter PA13:

- 0 = the pump is deactivated after delay PA3 and is activated with the thermoregulation request.
- 1 = the pump is deactivated after delay PA14; while the thermoregulation request is not present, the "Pulse" function is active.

3.8.1 Management of unit without pumps or with one pump

The parameters involved in activating the unit with one pump are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PA1	1 or 2	-	Users - Pump management
PA2	6	10 s	User - Compressor activation delay from pump start-up
PA3	3	10 s	Users - Pump Off delay from switch-off of compressors
PA4	6	10 s	Users - Pump Off delay from keypad / BMS / remote input switch-off
PA17	1	m	Users - Pump shutdown delay by remote digital input

A graphical example is shown below of the sequence with which the following takes place: the switching on of the unit of the pump (parameter PA1 = 1 or 2) and of the compressors and their switching off when the switching off of the unit takes place from the keypad (pump delay PA4) and from remote OK signal (pump delay PA17).

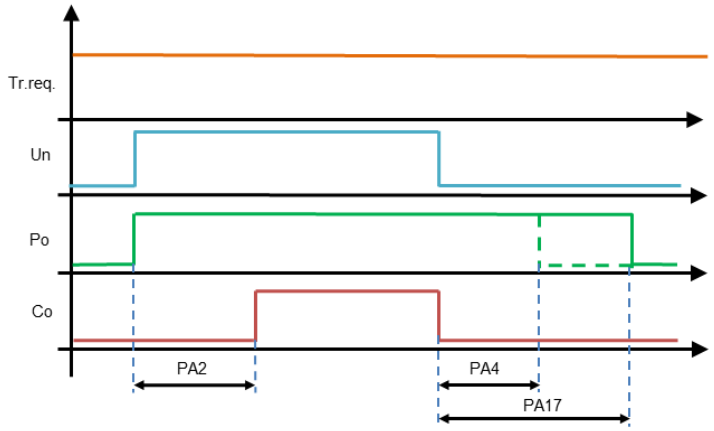


Fig. 15 Graph of the switching on and switching off of the unit, pump and compressor

In addition to the parameters present in the table, the other abbreviations in the graph indicate:

- Un = status of the unit
- Th.req. = thermoregulation request
- Po = status of the pump;
- Co = status of the compressors.

If management of at least one pump by the controller is not contemplated (parameter PA1 = 0), on starting, delay PA2 is not managed and, on switching off, delays PA4 and PA17 are not managed.

3.8.2 Management of the pumps in antifreeze function

With the controller, there is the possibility of using system water circulation to prevent freezing of the heat exchanger during periods when the machine is stopped.

So that water circulation can impede freezing of the exchanger, the unit must be electrically powered and circulation must not be prevented by the status of valves and taps.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PA1	1 or 2	-	Users - Pump management
PA9	1	-	Users - Antifreeze - Action of pumps in case of antifreeze alarm with unit off
PA10	5	-	Users - Antifreeze - Selection of antifreeze probe
PA11	4.0	°C	Users - Antifreeze - Pump activation threshold on antifreeze probe
PA12	4.0	°C	Users - Antifreeze - Pump deactivation differential on antifreeze probe

The value of parameter PA9 determines water circulation in unit OFF conditions or in any case with pumps deactivated:

- 0 = always deactivated
- 1 = activated at the same time as the antifreeze heaters
- 2 = activated with reference to the values of parameters PA11 and PA12

The value of parameter PA10 identifies the reference for activating the antifreeze protection and alarm that can be:

- PA10 = 1; the value read by the probe placed at the outlet of evaporator 1;
- PA10 = 6; the value read by the external air probe.

If one of the set probes has an error, it is excluded. If only one probe is set, then the pump will stay switched off.

3.8.3 Pulse Function

The “Pulse” function allows the pump to be switched on and switched off based on some set times when the request for starting up the compressors from thermoregulation is not present.

This function combines activation of the pump of the unit with the thermoregulation request.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PA1	2	-	Users - Pump management
PA13	1	-	User - Anti-sticking Enable anti-sticking function
PA14	60	s	Users - Pulse - Pump switch-off delay
PA15	5	m	Users - Pulse - Interval of time in which the pump is on with compressors off
PA16	5	m	Users - Pulse - Interval of time in which the pump is off with compressors off

The function is shown graphically in the diagram below.

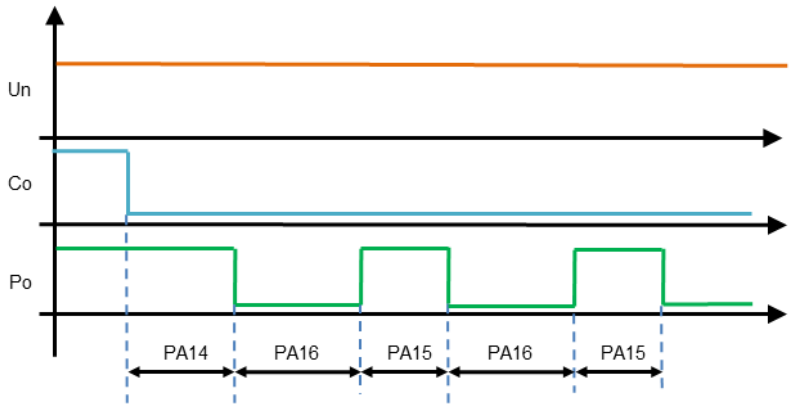


Fig. 16 "Pulse" function

In addition to the parameters of the table, the following abbreviations are present in the graph:

- Un = status of the unit
- Co = status of the compressors
- Po = status of the pumps.

3.9 User-side pump

The controller can control a water circulation valve.

The water circulation valve is controlled by the controller in connection with the user-side pump.

The control process consists in the following:

- pump start-up is delayed so that the valve can open fully;
- valve closing is delayed after pump switch-off.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PA39	90	s	Users - Delay for pump activation from permission for valve opening
PA42	90	s	Users - Delay for valve closing from pump deactivation

Below is a graphic illustration of the sequence followed to open and close the valve with respect to pump start-up and stop.

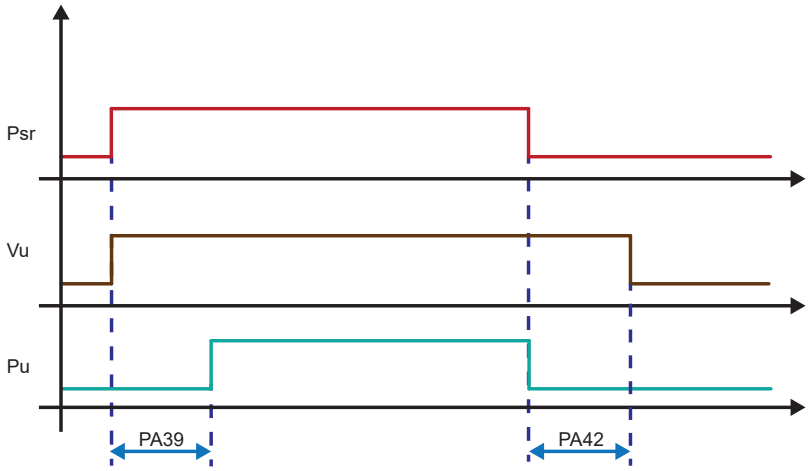


Fig. 17 Graph showing delayed valve opening and closing

In addition to the parameters present in the table, the other abbreviations in the graph indicate:

- Psr = request for pump start-up
- Vu = status of user-side valve
- Pu = status of user-side pump

The valve is always controlled in connection with the pump, irrespective of the control type selected in parameter PA1.

3.10 Liquid injection valve

To activate this function, the PTC discharge probe must be configured for each circuit present in the unit.

All the parameters involved with this function are shown in the table.

Parameter	Value	UM	Description
CO51	110	°C	Control of discharge temperature - Activation Setpoint of the liquid injection solenoid valve
CO52	10.0	°C	Screw - Differential activation of the liquid injection solenoid valve (discharge temp.)

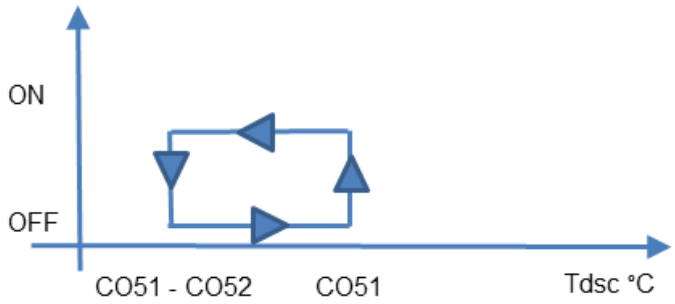


Fig. 18 Graphical representation of injection valve operation

When the temperature of the discharge gas (Tdsc) reaches the value of parameter CO51, injection of liquid is activated and remains active until the temperature falls to the value given by the difference CO51 - CO52.

3.11 Oil return

The oil return function consists of the increase in cooling capacity of the circuit when it remains at reduced capacity for a long time.

The increase in cooling capacity causes an increase in the speed of the refrigerant in the exchangers and facilitates oil return to the compressor.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
CO46	0	360	min	Oil return - Inverter: Delay in compressor override activation (0=disab.)
CO47	0	360	min	Oil return from inverter: override compressor time
CO48	0	100	%	Oil return - Inverter: Percentage capacity override during oil return function
CO49	0	100	%	Oil return - Inverter: Percentage activation threshold for oil return function

The function is present on all units.

The capacity reduction value that activates the function is factory set.

3.11.1 Oil return for compressors managed with inverter

All the parameters involved with this function are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO46	40	min	Oil return - Inverter: Delay in compressor override activation (0=disab.)
CO47	2	min	Oil return from inverter: override compressor time
CO48	50	%	Oil return - Inverter: Percentage capacity override during oil return function
CO49	30	%	Oil return - Inverter: Percentage activation threshold for oil return function

If the required cooling capacity involves operation of the compressor at a percentage lower than the value set in parameter "CO49", after the delay time set in parameter "CO46" has elapsed, the controller forces the operating percentage of the compressor to the value set in parameter "CO48" for a minimum time equal to the value set in parameter "CO47".

A graphical representation of the function is shown in the illustration.

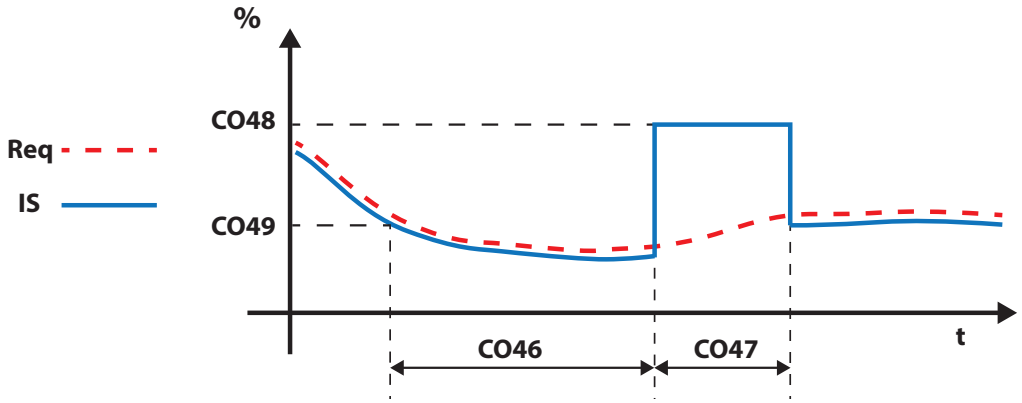


Fig. 19 Forcing of frequency for oil recovery

In addition to the parameters, the illustration also shows the abbreviations "IS", which refers to the inverter frequency trend, and "Req", which refers to the thermoregulation request.

If the compressor with inverter is connected in parallel with on-off compressors, the minimum speed of the refrigerant for oil return, is normally always guaranteed when an on-off compressor is running at the same time as the compressor with inverter.

3.12 Refrigerant leak detector management

The refrigerant leak detector is a system component that must always be in efficient conditions. In order for the detector to be efficient, it must be inspected/calibrated as instructed by the manufacturer.

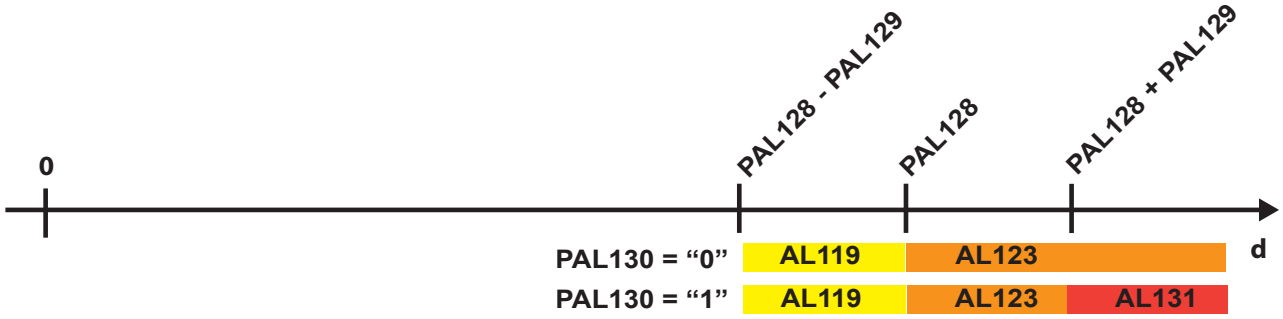
Based on the time of the last inspection/calibration, the controller generates messages/alarms to warn about maintenance being needed.

3.12.1 Function management

The parameters involved in the management of the function are shown in the table.

Parameter	Min	Max	UM	Description
PAL128	0	999	dd	Nominal interval between leak detector calibrations/replacements (0 = disabled)
PAL129	0	50	dd	No. days for final warning message/alarm
PAL130	0	1	-	Leak detector calibration/replacement time ended

A graphical representation is shown below.

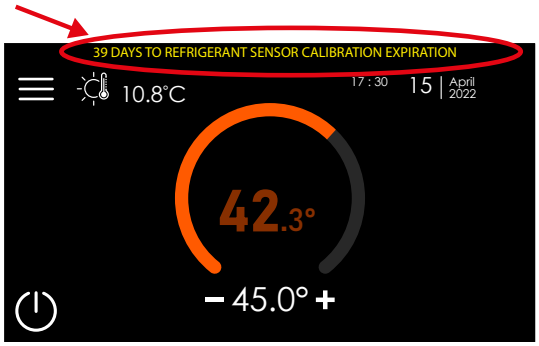


Parameter "PAL128" is used in the factory to set the number of days within which the sensor in the leak detector needs to be maintained.

A message appears on the main screen to warn the operator about the days missing before the maintenance deadline, as the day specified in parameter "PAL128" approaches. The subtraction of the value in "PAL28" from the value in "PAL129" gives the day on which this alert starts being displayed.

In addition to the message appearing on the main screen, an alarm message ("AL119") appears in the alarms list.

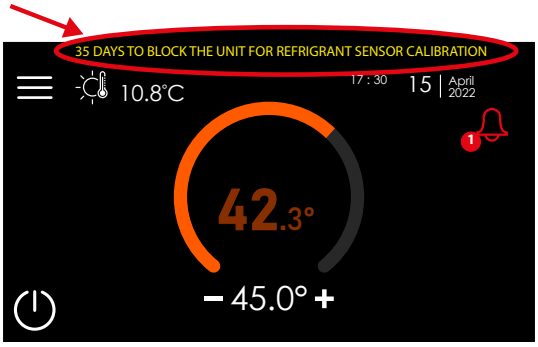
A service level password is needed to clear the message from the main screen and the alarm from the alarms list.



If the value in parameter "PAL130" is "1" and the number of days specified in parameter "PAL128" is exceeded, a message appears on the main screen, in addition to the message warning about the calibration time having expired, to inform the operator about the number of days missing before the unit is blocked. The unit will continue to operate for the number of days specified in parameter "PAL129".

Alarm "AL123" will continue to be active in the alarms list.

As was the case in the examples above, a service level password is needed to clear the message from the main screen and to unblock the unit.



The controller blocks the unit after the days specified in the alert have elapsed.

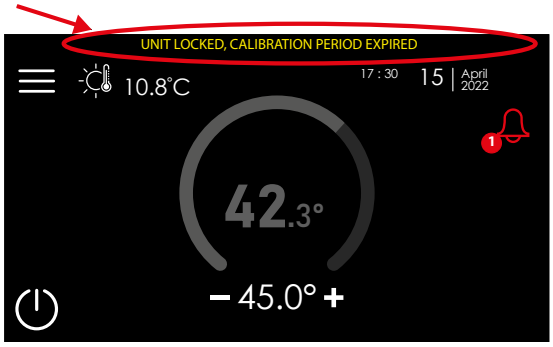
When the unit is blocked, a message appears on the main screen to inform that the unit has been blocked because the calibration time has expired.

Alarm message “AL131” becomes active in the alarms list.

The controller blocks the unit after the days specified in the alert have elapsed.

When the unit is blocked, a message appears on the main screen to inform that the unit has been blocked because the calibration time has expired.

Alarm message “AL342” becomes active in the alarms list.



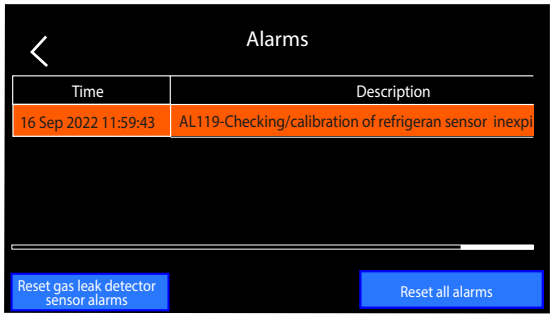
As was the case in the examples above, a service level password is needed to clear the message from the main screen and to unblock the unit.

3.12.2 Alarm clearing procedure (password-protected)

Leak detector sensor inspection and calibration are maintenance operations that only qualified staff are authorised to perform.

This is why the alarm messages must be cleared and the unit must be unblocked using the password required for access to password-protected service branches.

The figure below shows the screen with the alarm loop featuring an active alarm that requires entry of a service password for clearing.



A click on the “clear alarm” area concerning the gas leak detector sensor opens a screen which requires entry of a password.

To clear the alarm, the operator has to select the “service” profile and to enter the relevant password.

3.13 Refrigerant leak detection management

This function manages refrigerant leaks.

Leaks are controlled through a refrigerant detector whose sensor is installed in the compressor compartment of the unit.

On the controller, for each refrigerant circuit of the unit, there are digital inputs to which the refrigerant detectors are connected.

If the amount of refrigerant measured by the sensor exceeds the alarm threshold, the detector opens a digital input of the controller of the unit.

Depending on the settings, in case of refrigerant leaks, the controller stops the relevant circuit in pump down or just gives a warning.

3.13.1 Stop due to refrigerant leak

A graphical representation is shown below.

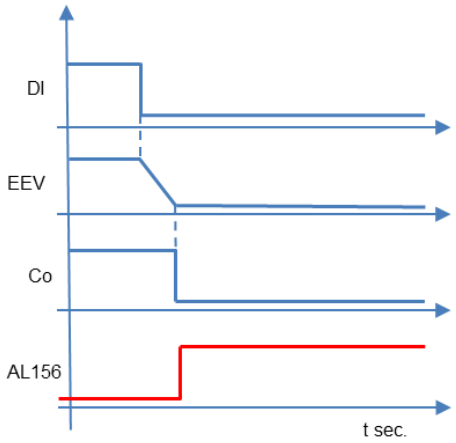


Fig. 20 Leak detector

The abbreviations of the graph indicate:

- DI = digital input regarding the refrigerant detector
- EEV = electronic expansion valve
- Co = OK signal to the refrigerant circuit
- ALL = activation of the alarm.

The stages of the graph are as follows:

- opening of the digital input of the controller by the refrigerant detector;
- the controller forces the closing of the electronic expansion valve;
- when the electronic expansion valve closes, the controller stops the refrigerant circuit involved;
- with the stopping of the circuit, the alarm is signalled.

3.13.2 Refrigerant leak warning

With management of just the refrigerant leak warning, when the digital input of the controller is opened by the leak detector, the alarm is activated while the refrigerant circuit continues with normal operation.

3.14 Defrost

Defrosting is a procedure in which frost accumulation on the condensing/evaporating coil is prevented and/or any frost that has formed is removed during operation in heat pump mode of an air/water unit.

An effective defrost cycle ends with a completely clean condensing/evaporating coil.

The controller manages defrosting differently according to the settings made and the air temperature conditions.

Parameter	Min	Max	UM	Description
DF1	0	2	-	Defrost method
DF10	-50.0	110.0	°C	Fixed evaporating threshold to start defrost
DF11	0	999	s	Defrost start delay
DF12	-1.00	1.00	-	Moving defrost - Parameter A with full load
DF13	-100.0	100.0	-	Moving defrost - Parameter B with full load
DF14	0	1	-	Moving defrost - Enable under partial load
DF15	-1.00	1.00	-	DF16
DF16	-100.0	100.0	-	Moving defrost - Parameter B with partial load
DF17	0	999	min	Delay to defrost after the unit is switched on
DF18	0	999	min	Time interval between two defrost cycles of the same circuit
DF20	No	Yes	-	Enable manual defrost - from keypad
DF21	-50.0	110.0	°C	Evaporating temperature threshold for activating a forced defrost
DF22	0	999	s	Delay time for forced defrost
DF23	-10.0	10.0	s	Adaptive defrost - d parameter - Minimum value
DF24	-10.0	10.0	°C	Adaptive defrost - d parameter - Maximum value
DF25	-5.0	25.0	°C	Max. setpoint for defrost start (DF10 + DF25)
DF26	-25.0	50.0	°C	Protective defrost - Trigger threshold for external air temperature
DF27	0	24	hr	Protective defrost - Cumulative time (0 = Disabled)
DF28	0.0	65.0	°C	Adaptive defrost - End defrost setpoint - Minimum value
DF29	0.0	65.0	°C	Adaptive defrost - End defrost setpoint - Maximum value
DF30	0	2	-	Defrost entry method
DF31	0	999	s	Forcing time of circuit at 100% on entering defrost mode (if DF30=0)
DF32	0	999	s	Forcing time of circuit at minimum on entering defrost mode (if DF30=1)
DF33	0	999	s	Forcing time of circuit OFF on entering defrost mode (if DF30=2)
DF34	-50.0	110.0	°C	Outside air temperature limit for air defrost
DF49	-50.0	110.0	°C	End-of-defrost threshold for condensing temperature
DF50	1	300	s	Minimum defrost duration time
DF51	10	999	s	Maximum defrost time
DF52	0	100	s	Inverter - Pre defrost percentage
DF53	0	100	%	Inverter - Percentage during defrost
DF54	0	100	%	Inverter - Percentage after defrost
DF60	0	999	s	Time end defrost (dripping time)
DF61	0	2	s	Defrost exit method
DF62	0	999	-	Capacity reduction time in compressors at end of defrost cycle (if DF61 = 1)
DF63	0	999	s	Time compressors are OFF during end of defrost (if DF61=2)

Activation of simultaneous or separate defrost of the refrigerant circuits and the start conditions at fixed or sliding evaporating pressure are done at the factory.

The stages of a defrost cycle are as follows:

- check of defrost start conditions (at fixed or sliding evaporating pressure);
- check of type of defrost to carry out (with air or with refrigeration cycle reversal);
- preparation for cycle reversal;
- refrigeration cycle reversal and defrost of the condensing/evaporating coil;
- check of complete defrosting;
- preparation and new cycle reversal with return to operation in heating mode.

To complete defrost management, in addition to the main stages, the controller gives the possibility of manual forcing by operators or automatic forcing when particular conditions occur.

3.14.1 Check of conditions for the defrost cycle at fixed evaporating temperature

By measuring the operating values of the unit, the controller checks whether there are the conditions for which a defrost is necessary.

The conditions for starting a defrost cycle are as follows:

- the evaporating temperature value must be lower than the defrost start threshold set in parameter dF10;
- the condition must be maintained for at least the time set in parameter dF11;
- the unit must have been running for at least the time set in parameter dF17;
- the time set in parameter dF18 must have passed since the previous defrost of the same circuit;
- in case of defrost cycles in separate circuits, the time set in parameter dF19 must have passed since the defrost of the last circuit.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF1	1	-	Defrost method
dF10	-12.0	°C	Fixed evaporating threshold to start defrost
dF11	120	s	Defrost start delay
dF17	10	min	Delay to defrost after the unit is switched on
dF18	30	min	Time interval between two defrost cycles of the same circuit

Do not change the set values without the manufacturer's approval.

3.14.2 Check of conditions for the defrost cycle at sliding evaporating temperature

By measuring the operating values of the unit, the controller checks whether there are the conditions for which a defrost is necessary.

Unlike the defrost cycle at fixed evaporating temperature, the defrost cycle at sliding evaporating temperature is linked to the air temperature and to correction coefficients A and B.

The conditions for starting a defrost cycle are as follows:

- the evaporating temperature value must be lower than the sliding defrost start threshold;
- the condition must be maintained for at least the time set in parameter dF11;
- the unit must have been running for at least the time set in parameter dF17;
- the time set in parameter dF18 must have passed since the previous defrost of the same circuit;
- in case of defrost cycles in separate circuits, the time set in parameter dF19 must have passed since the defrost of the last circuit.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF1	2	-	Defrost method
dF11	120	s	Defrost start delay
dF12	0.70	-	Moving defrost - Parameter A with full load
dF13	14.0	-	Moving defrost - Parameter B with full load
dF15	0.70	-	DF16
dF16	13.0	-	Moving defrost - Parameter B with partial load
dF17	10	min	Delay to defrost after the unit is switched on
dF18	30	min	Time interval between two defrost cycles of the same circuit

Do not change the set values without the manufacturer's approval.

3.14.3 Type of defrost

After verifying that there are conditions requiring a defrost, the controller selects the most efficient type of defrost as regards the operating conditions of the unit.

The choice of the type of defrost depends on the ambient air temperature.

If the ambient air temperature is higher than the value set in parameter dF34, the controller starts an air defrost otherwise it starts the procedure for a defrost with refrigeration cycle reversal.

3.14.4 Air defrost

The parameters involved in an air defrost are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF34	15.0	°C	Outside air temperature limit for air defrost
dF51	300	s	Maximum defrost time

The air defrost takes place with the stopping of the compressors of the refrigeration circuits involved and keeping ventilation at maximum.

The air defrost cycle ends when the maximum defrost duration time has elapsed.

3.14.5 Preparation for cycle reversal

If an air defrost cannot be done, the controller carries out a defrost with refrigeration cycle reversal by operating a 4-way valve.

Depending on the set parameters, refrigeration cycle reversal can take place in different ways linked to the value of parameter dF30.

The cycle reversals envisaged with the value of parameter dF30 are:

- 0 = with 100% of the refrigeration capacity before reversal;
- 1 = with capacity reduction to the minimum refrigeration capacity before reversal;
- 2 = with compressor(s) not running.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF30	1	-	Defrost entry method
dF31	60	s	Forcing time of circuit at 100% on entering defrost mode (if DF30=0)
dF32	30	s	Forcing time of circuit at minimum on entering defrost mode (if DF30=1)
dF33	20	s	Forcing time of circuit OFF on entering defrost mode (if DF30=2)

Depending on the value set in parameter dF30, before refrigeration cycle reversal, the controller maintains the condition for the time set in the values of parameters dF31 or dF32 or dF33.

3.14.6 Refrigeration cycle reversal and defrost

With reversal of the refrigeration cycle and the stopping of ventilation, defrosting of the coil starts.

The parameters involved are shown in the table.

Parameter	Value	UM	Description
dF45	1 - Yes	-	Ventilation during defrost
dF46	43.0	°C	Defrost ventilation activation threshold
dF47	3.0	°C	Defrost ventilation deactivation differential
dF48	5.0	°C	Reverse ventilation deactivation threshold for coil temperature (DF45 = 1)
dF49	48.0	°C	End-of-defrost threshold for condensing temperature
dF50	10	s	Minimum defrost duration time
dF51	300	s	Maximum defrost time

In these conditions, the heat produced by the delivery gas warms the coil and melts the frost present. The checks and actions carried out by the controller during this stage are as follows:

- checking that defrosting has not been stopped accidentally and that it continues for at least the minimum time;
- management of the gradual increase in condensing pressure;
- measurement of coil temperature to check the state of defrost;
- if reverse ventilation is enabled, maintenance of the condensing pressure value below the end-of-defrost threshold, otherwise if reverse ventilation is not enabled, the end-of-defrost threshold is reached;
- maintenance of the condensing pressure below the end-of-defrost threshold is done with activation of reverse ventilation;
- when the end-of-defrost temperature is reached on the coil, the reverse ventilation action is prevented and the condensing pressure is allowed to reach the end-of-defrost threshold;
- checking that the defrost time does not exceed the maximum duration; if this happens, the defrost stops;
- indifferently of the conditions that lead to the end of the defrost (due to reaching the end-of-defrost threshold or due to reaching the time limit), the next action is preparation for return of operation in heating mode.

When simultaneous defrost cycles are to be carried out, reverse ventilation is stopped only when the temperature of all the coils involved has exceeded the end-of-defrost temperature threshold.

If the temperature probe is not present in the coil, reverse ventilation is not enabled.

3.14.7 Preparation and new cycle reversal

Whatever way a defrost with refrigeration cycle reversal is ended (due to reaching the end-of-defrost threshold or due to reaching the time limit), the next stage is preparation for a new reversal of the refrigeration cycle and then resumption of operation in heating mode.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF60	15	s	Time end defrost (dripping time)
dF61	1	-	Defrost exit method
dF63	0	s	Time compressors are OFF during end of defrost (if DF61=2)

When defrosting of the coil is finished, the next steps that the controller manages are the following:

- activation of ventilation to lower the condensing pressure and preparation of the envisaged defrost exit method;
- after the time set as ventilation advance has passed, the controller reverses the refrigeration cycle again, through the 4-way valve, and the circuit resumes operation in heating mode.

3.14.8 Forcing of a defrost cycle

The starting of a defrost can take place normally or through manual or automatic forcing.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
dF20	1 - Yes	-	Enable manual defrost - from keypad
dF21	-20.0	°C	Evaporating temperature threshold for activating a forced defrost
dF22	10	s	Delay time for forced defrost

When parameter dF20 is enabled, a defrost can be forced from the keypad.

If operating conditions make it necessary, the operator can force the controller, from the keypad, to carry out defrost cycles without needing to comply with the set delays.

So that a defrost can take place, sufficient thermal inertia must in any case be present in the system.

Failing this, the protective devices may trip, and if this happens repeatedly, the compressors can be damaged.

The controller activates a "forced" defrost, ignoring the set delays, when the evaporating temperature reaches the threshold set in the value of parameter dF21 and is maintained for the time set in parameter dF22.

3.15 Anti Ice Circuit

In order to prevent ice from forming at the base of the air exchanger working as an evaporator, the last supply is used for the operation of the Anti-Ice Circuit.

The controller manages this part of the exchanger through a digital outlet that powers a solenoid valve.

The solenoid valve is powered when the air exchanger works as an evaporator and during defrosting if the temperature of the air is lower than the activation threshold, but it is always powered when the exchanger works as a condenser

When conditions are suitable for activation, the function can be activated with a pause-work cycle depending on parameters "CO34" and "CO35".

If only one of the two parameters is set to "zero", when conditions are suitable, the function is always active.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO34	120	s	Force time On solenoid valve YV.V, Anti-Ice Circuit (0 = disabled)
CO35	480	s	Anti-ice circuit - Time to OFF with spillage from valve YV.V
CO68	5.0	°C	Anti-Ice Circuit – Minimum YV.V activation threshold
CO69	1.0	°C	Anti-Ice Circuit – YV.V activation differential

While the air exchanger is working as an evaporator, this function is automatically deactivated when the temperature of the air exceeds the activation threshold by the relevant differential.

3.16 Anti-freeze heaters

During operation of the units, or while they are in stand-by conditions and the ambient temperature is below zero, the water inside the exchangers can freeze.

Ice formation inside the exchangers can irreparably damage them.

To prevent ice formation inside the exchangers, the controller can manage auxiliary heaters.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
AR1	-50.0	110.0	°C	Users - Anti-freeze heaters activation setpoint
AR2	0.1	25.5	°C	Users - Anti-freeze heaters activation differential

3.16.1 Heater set point and differential

Activation of the output of the heaters takes place when the temperature value read by the reference probe reaches the set point value. Deactivation takes place when the activation temperature plus the differential is reached.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AR1	4.0	°C	Users - Anti-freeze heaters activation setpoint
AR2	2.0	°C	Users - Anti-freeze heaters activation differential

A graphical representation is shown below.

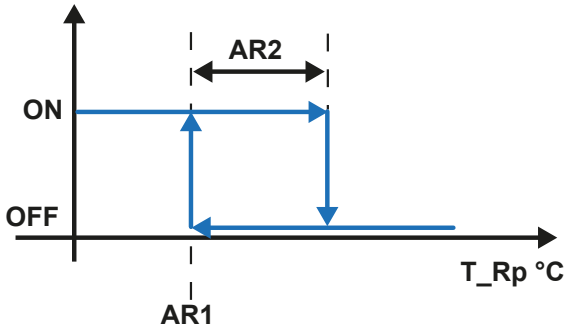


Fig. 21 Management of heater outputs

In addition to the parameters in the table, the following abbreviations are present in the graph:

- ON = heater output active
- OFF = heater output not active
- T_Rp = temperature read by the reference probe.

3.16.2 Reference probe

Depending on the unit, there can be one or more reference probes for activation of the heater output.

The number of probes present is linked to the type of unit and to the number of water exchangers.

For air/water units, the cases can be the following:

- in the case of one exchanger, the reference probe is the one installed on the water outlet;
- in the case of more than one exchanger, the reference probes are those installed on the outlet of each exchanger and the one installed in the common section at the outlet of the unit.

If there is more than one reference probe for management of the antifreeze heaters, only one of them needs to read the activation temperature in order for the heaters to be activated.

3.17 Heater in condensate drip tray

This function is intended to prevent freezing of the water that forms in the condensate drip tray during the defrost cycles.

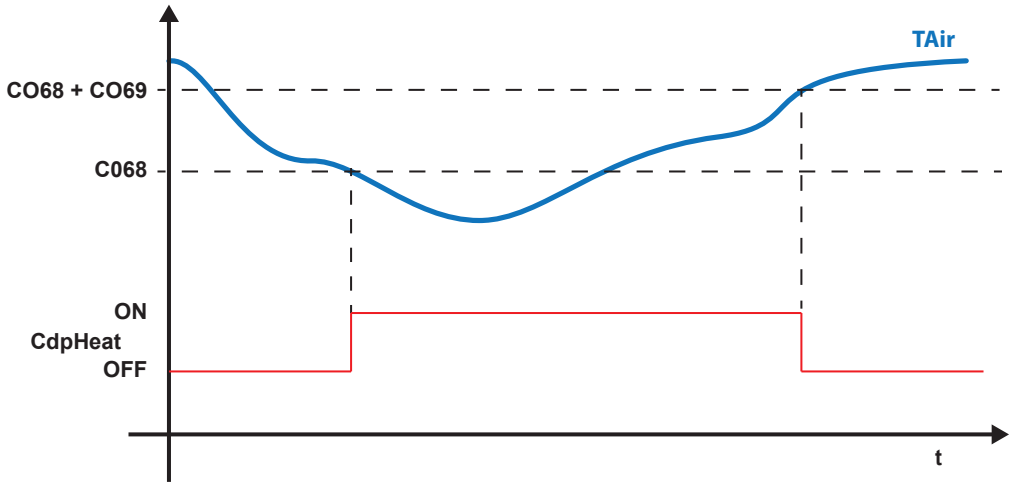
The function gets activated when the air temperature value is below the activation threshold.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO68	32,0	°F	Anti-Ice Circuit - Min. threshold for antifreeze heater activation in tray (RAV)
CO69	3,6	°F	Anti-Ice Circuit - Differential for antifreeze heater activation in tray (RAV)

A graphical representation of the function is shown below.



In addition to the references present in the table, the abbreviations in the graph are:

- Tair = air temperature;
- CdpHeat = Status of output in condensate drip tray heater

If the value of the air temperature is smaller than the setpoint stored in the activation threshold (“CO68”), the controller enables the output in the condensate drip tray heater.

The function gets de-activated when the air temperature value exceeds the differential setpoint in parameter “CO69” with respect to the threshold set in parameter “CO68”.

If the necessary conditions are met, the function is active irrespective of the unit operating status.

The function is always active if the temperature probe experiences a malfunction.

3.18 Auxiliary heating

This function allows management of a heating device to supplement operation in heat pump mode or as an alternative to it.

The controller can manage up to 4 digital outputs to obtain 4 steps and a 0/10 V analogue output.

Activation of this function is possible only for units that can operate in heat pump mode.

According to the settings, the ways the function is managed are:

- auxiliary heating with the same set point as operation in heat pump mode;
- auxiliary heating with set point linked to operation in heat pump mode;
- auxiliary heating with set point independent of operation in heat pump mode;

With these ways of management, there are the conditions for activation of heating and deactivation of compressor operation, linked to the outside air temperature and delays.

Also, with parameter AH15, activation of auxiliary heating can be forced during a defrost.

The parameters that manage the function are shown in the table.

Parameter	Min	Max	UM	Description
AH2	-50.0	110.0	°C	Outside air setpoint for activation
AH3	0.1	25.5	°C	Outside air differential for de-activation
AH4	0	999	min	Auxiliary heating activation delay
AH5	-50.0	110.0	°C	Integration - Outside air setpoint required to disable compressors
AH6	0.1	25.5	°C	Integration - Outside air differential required to enable compressors
AH7	0	999	min	Integration - Delay in compressor switch-off
AH8	0	2	-	Type of temperature control
AH9	-50.0	110.0	°C	Heating ON/OFF - Main probe setpoint on hot side
AH10	0.1	25.5	°C	Heating ON/OFF - Proportional band
AH16	0	1	-	Enables auxiliary heating during defrost

3.18.1 Conditions as the air temperature changes

The air temperature intervenes in the activation of auxiliary heating and in the deactivation of the compressors in heat pump operating mode.

For activation of auxiliary heating, the air temperature must be lower than parameter AH2 for time AH4.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AH2	5.0	°C	Outside air setpoint for activation
AH3	1.0	°C	Outside air differential for de-activation
AH4	5	min	Auxiliary heating activation delay

As regards air temperature, with the setting of parameter AH5, it is possible to decide on deactivation of the operation of the compressors after delay AH7.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AH5	0.0	°C	Integration - Outside air setpoint required to disable compressors
AH6	1.0	°C	Integration - Outside air differential required to enable compressors
AH7	5	min	Integration - Delay in compressor switch-off

A graphical representation is shown below.

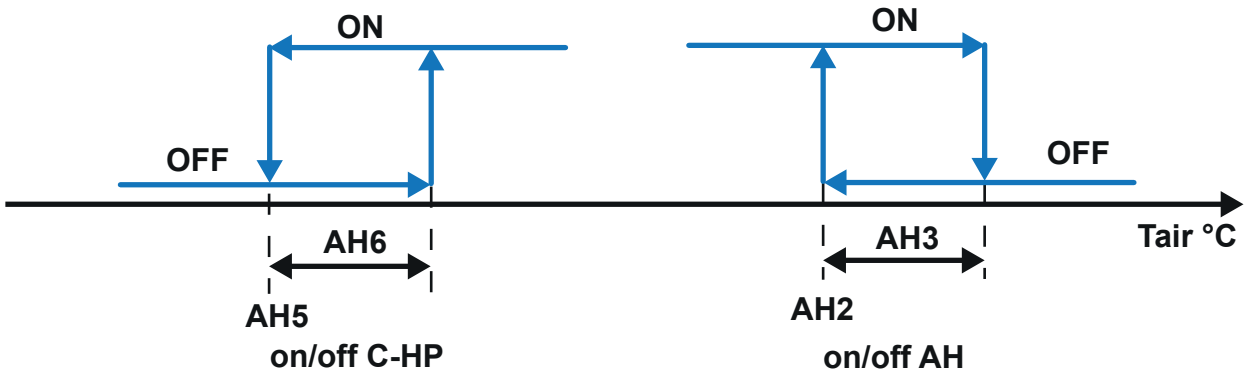


Fig. 22 Air conditions for management of auxiliary heating and compressors

In addition to the references present in the table, the abbreviations in the graph are:

- Tair = air temperature;
- on/off C-HP = air temperature condition for deactivation of the compressors in heat pump operating mode;
- on/off AH = air temperature condition for activation of auxiliary heating.

In the case of alarms regarding the probes involved in control, the outputs relevant to the function will always be deactivated.

3.18.2 Auxiliary heating with the same set point as operation in heat pump mode

This control function is used to activate auxiliary heating, through both the digital outputs and the analogue output, with the same operating set point and differential in heat pump mode of the compressors; auxiliary heating will be substitutive to operation in heat pump mode of the unit.

With activation of the first step of auxiliary heating, the switching off of the compressors will be forced.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AH8	0	-	Type of temperature control
AH9	STH4	°C	Heating ON/OFF - Main probe setpoint on hot side
AH10	STH8	°C	Heating ON/OFF - Proportional band

A graphical representation is shown below.

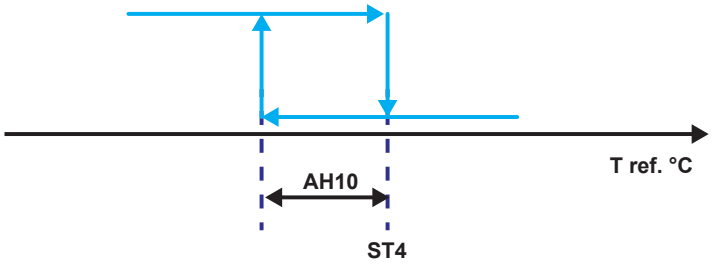


Fig. 23 Output auxiliary heating with same setpoint as operation in heat pump mode

In addition to the references present in the table, T ref = reference water temperature.

3.18.3 Auxiliary heating with set point linked to operation in heat pump mode

This control function is used to activate auxiliary heating with off-sets from the set point of the compressors in operation in heat pump mode; in this way, changing the set point of the compressors automatically changes the activation of auxiliary heating.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AH8	2	-	Type of temperature control
AH9	4.0	°C	Heating ON/OFF - Main probe setpoint on hot side
AH10	2.0	°C	Heating ON/OFF - Proportional band

A graphical representation is shown below.

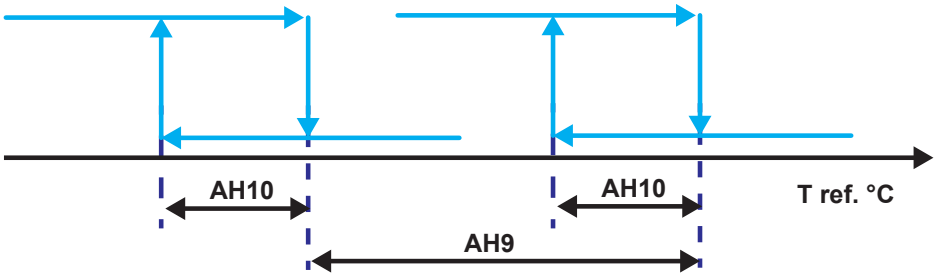


Fig. 24 Output auxiliary heating with off-set

In addition to the references present in the table, T ref = reference water temperature.

3.18.4 Auxiliary heating with independent set point

This control function is used to activate auxiliary heating with its own set points and differentials; in this way, its management is not linked to the set point of the compressors in operation in heat pump mode.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
AH8	1	-	Type of temperature control
AH9	37.0	°C	Heating ON/OFF - Main probe setpoint on hot side
AH10	2.0	°C	Heating ON/OFF - Proportional band

A graphical representation is shown below.

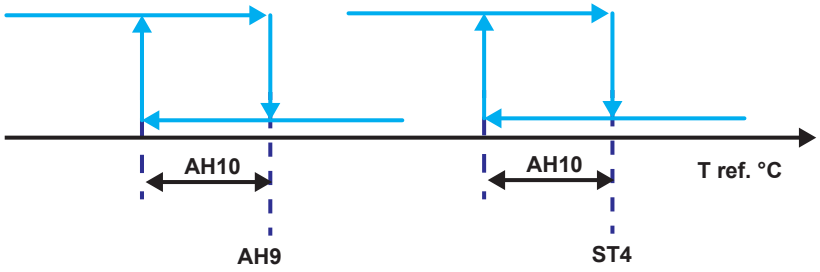


Fig. 25 Output auxiliary heating with independent setpoint

In addition to the references present in the table, T ref = reference water temperature.

3.19 “ACS” function

The “ACS” function is designed for the production of hot water for sanitary use, which prioritises the system demand.

3.19.1 General

This function enables the controller to manage a 3-way valve to divert the water flow, which goes through the heat exchanger in the unit, towards the hydraulic circuit of the enabled function.

A temperature sensor and a dedicated temperature regulation function are featured in the controller to sense the demand from the sanitary circuit.

The demand from the sanitary circuit is always prioritised regardless of the active function in the air conditioning circuit (cooling or heating).

Any operating switch to/from the sanitary circuit causes the pump to stop, the water flow to be diverted by the 3-way valve, the pump to be re-started and the compressors to be enabled depending on the demand from the enabled temperature regulation function.

If no demand is received from the sanitary circuit, the 3-way valve enables direct flow of water into the system circuit.

The 3-way valve keeps its position and lets the water flow directly to the sanitary circuit if sanitary circuit mode only is enabled.

If this is the case, once the demand from the temperature regulation function is met, the controller stops the pump.

The figure shows an outline hydraulic diagram with the main components.

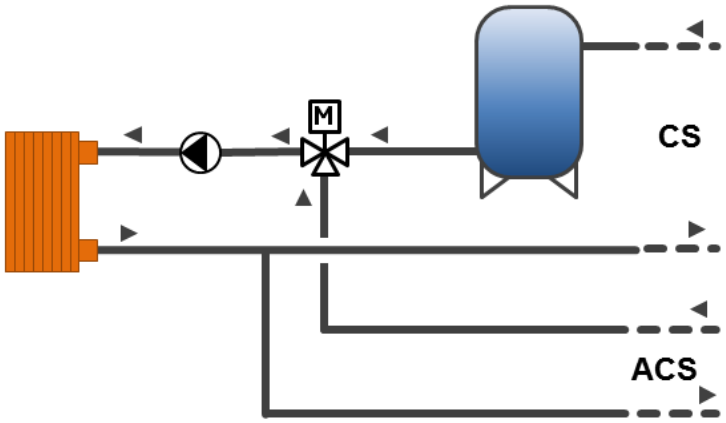


Fig. 26 Outline hydraulic diagram

In addition to controlling the activation of the compressors used to heat the water for the sanitary system, the controller can manage up to 4 additional power steps thanks to digital outputs.

These digital outputs can be connected to heaters or any other external source of heating from the unit.

The external heating sources may be used to either support or replace the compressors for specific functions.

In units where this function is featured the controller offers the opportunity to manage the two systems separately.

In addition to a general signal to operate the unit, signals are featured for each individual function.

The table shows the parameters that manage this function.

Parameter	Min	Max	UM	Description
ACS1	0	1	-	Enabling of domestic hot water
ACS2	0	1	-	Enables setpoint from BMS
ACS3	ACS5	ACS6	°C	Setpoint
ACS4	0	25.0	°C	Control diff.
ACS5	-50.0	ACS6	°C	Minimum Setpoint
ACS6	ACS5	110	°C	Maximum Setpoint
ACS7	-50.0	110	°C	Forced output set point
ACS8	0.1	25.0	°C	Re-enabling diff. from forced output
ACS9	0	250	min	Minimum cut-off from forced output
ACS10	0	999	min	Activation delay
ACS11	0	999	s	Deactivation delay
ACS12	0	240	min	Compressor forcing activation delay
ACS13	0	240	min	Time of subsequent activations of compressors after ACS12
ACS14	ACS15	ACS16	°C	Anti-legionella - Set point
ACS15	-50.0	ACS16	°C	Anti legionella - Minimum Setpoint
ACS16	ACS5	110.0	°C	Anti legionella - Maximum Setpoint
ACS17	0	24	h	Anti-legionella - Time of activation
ACS18	0	7	-	Anti-legionella - Day of activation
ACS19	0.1	25.0	°C	Anti-legionella - Control differential
ACS20	0	999	°C	Anti-legionella - Override
ACS21	1	250	min	Anti-legionella - Minimum duration
ACS22	1	250	min	Anti legionella - Maximum duration
ACS23	0	1	-	Anti-legionella - Enabling
ACS25	-30.0	65.0	°C	Outside Air - DHW setpoint decrease triggering point
ACS26	-30.0	65.0	°C	Outside Air - Minimum limit for DHW setpoint decrease
ACS27	0.0	65.0	°C	Outside Air - Maximum setpoint at low temperature
ACS28	0	999	min	Maximum DHW production duration time
ACS29	0	60	-	DHW forced output alarm due to temperature, maximum number of attemp-ts per hour
ACS31	0	999	min	Three-way valve movement time
ACS32	0	999	min	Delay time for disappearance of the VAI49 probe alarm
ACS35	0	1	-	Enables DHW integration heaters
ACS36	0	1	-	Enables heaters as an integration to compressors in defrost mode
ACS37	0	3600	s	Switching on time between steps of heaters in defrost mode
ACS38	0	180	min	Switching on time between steps of heaters in DHW mode
ACS38	0	1	-	DHW heater alarm management
ACS41	0	24	h/min	Start of time band 1 for DHW production
ACS42	0	24	h/min	End of time band 1 for DHW production
ACS43	0	24	h/min	Start of time band 2 for DHW production
ACS44	0	24	h/min	End of time band 2 for DHW production
ACS45	0	24	h/min	Start of time band 3 for DHW production
ACS46	0	24	h/min	End of time band 3 for DHW production
ACS47	0	7	-	Sunday - operation with time band
ACS48	0	7	-	Monday - operation with time band
ACS49	0	7	-	Tuesday - operation with time band
ACS50	0	7	-	Wednesday - operation with time band
ACS51	0	7	-	Thursday - operation with time band
ACS52	0	7	-	Friday - operation with time band
ACS53	0	7	-	Saturday - operation with time band
ACS54	-30.0	30.0	°C	Setpoint variation during time band
ACS55	0	2	-	Action upon ACS demand
ACS57	0	50.0	°C	Regulation differential for delivery or return line monitoring
ACS58	0	50.0	°C	Increase of regulation setpoint for delivery line monitoring

The following parameters listed in the table are also controlled for the production of hot water for the air conditioning system.

Parameter	Min	Max	UM	Description
ST6	28.0	65.0	-	Heat Pump - Maximum Setpoint
SD15	-30.0	65.0	°C	Operating limit - HP setpoint reduction start point
SD16	-30.0	65.0	°C	Operating limit - Minimum outside temperature limit for HP setpoint reduction
SD17	0.0	65.0	°C	Operating limit - Maximum setpoint with low outside air temperature

3.19.2 Enable/Disable buttons and view pages

The “ACS” icon in the password-protected menu gives access to all the parameters associated with the function.

The colour of the symbols featured in the first screen is in connection with the function being enabled or not.

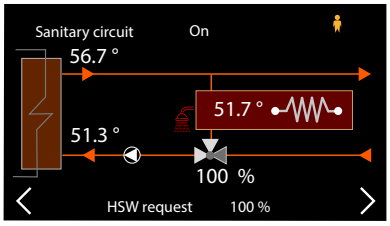


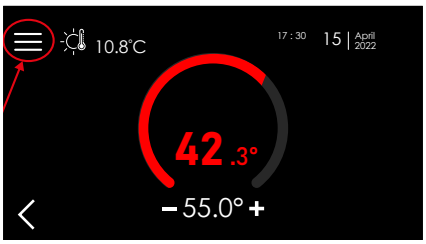
Fig. 27 “ACS” screen with function enabled

The right-hand arrow on the first screen gives access to the main parameters of the function. Access to all the “ACS” parameters is gained from the “Parameters” menu.

The operating status and the relevant values are easy to view using the “ACS” icon on the main screen.

A screen pops up where it is possible to edit the setpoint value.

The “ACS” icon in the drop-down menu on the top left side, as shown in the figure, gives access to the screen where the “ACS” function and the system can be enabled and disabled.



The next screen is used to set the parameters to control the anti Legionella cycle.

3.19.3 Changes in operation

Any time the system switches to a new operating mode the pump stops for the time required for the 3-way valve to divert the flow of water.

If the demand from the sanitary circuit is received while the compressors are in operation, the controller stops the compressors before stopping the pump.

The production of hot water for the sanitary circuit may be concluded as soon as the setpoint is achieved or the max. time has elapsed.

Regardless of the reason why the production of hot water for the sanitary circuit is stopped, the time set in parameter “ACS10” has to elapse before the next demand can be fulfilled.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS10	45.0	min	Activation delay
ACS11	45.0	s	Deactivation delay
ACS31	2.0	min	Three-way valve movement time
CO2	180	s	Minimum OFF time
PA2	6	10 s	User - Compressor activation delay from pump start-up
PA3	3	10 s	Users - Pump Off delay from switch-off of compressors

Below is a graphical representation of the operating steps required to switch from air conditioning to sanitary mode, and vice versa.

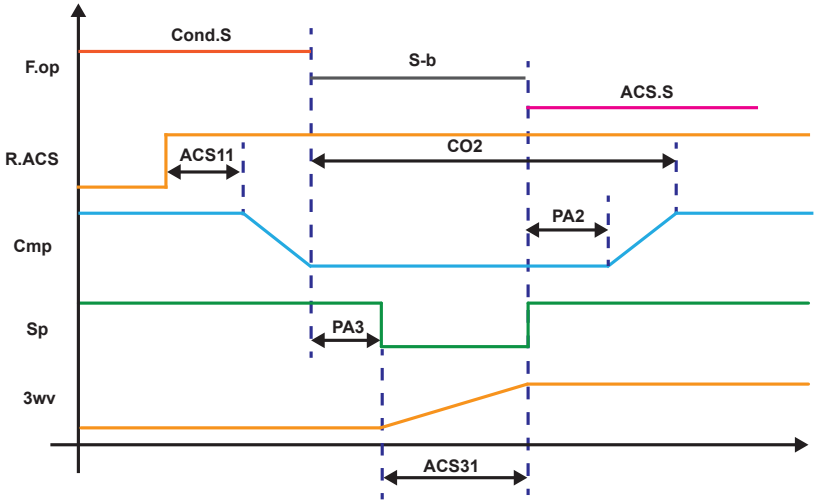


Fig. 28 Switch from air conditioning to sanitary mode

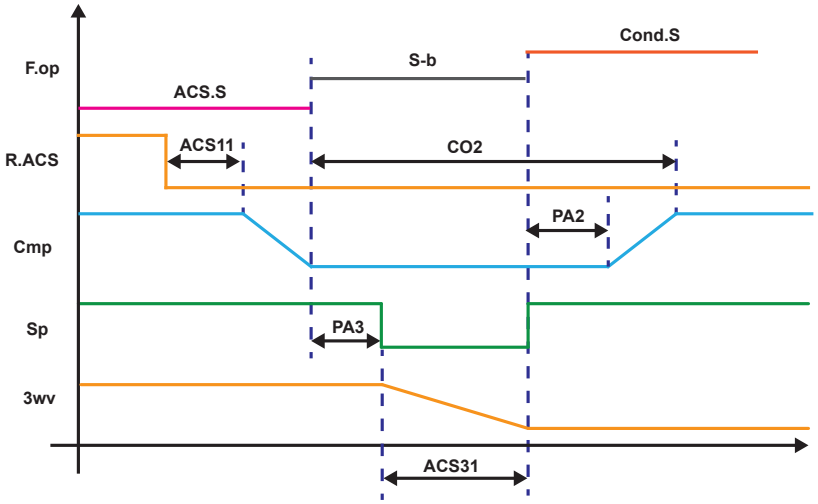


Fig. 29 Switch from sanitary to air conditioning mode

In addition to the parameters present in the table, the other abbreviations in the graph indicate:

- F.op = enabled function;
- Cond.S = unit operating in air conditioning mode;
- ACS.S = unit operating in sanitary mode;
- R.ACS = status of demand from sanitary system;
- Cmp = compressor status;
- Sp = status of pumps featured in the system;
- 3WV = 3-way valve status;
- S-B = unit in standby during operating mode switching.

If the demand for hot sanitary water is received when there is no demand from the air conditioning system, the delays due to the compressor switch-off are ignored. Similarly, if the pump is not in operation (pulse function enabled), the relating delay is ignored.

3.19.4 “ACS” temperature regulation

The demand for the production of hot sanitary water engages the compressors as the reference temperature drops below the setpoint within the corresponding differential.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS3	45.0	°C	Setpoint
ACS4	2.0	°C	Control diff.
ACS5	40.0	°C	Minimum Setpoint
ACS6	50.0	°C	Maximum Setpoint
ACS7	60	°C	Forced output set point
ACS10	8	min	Activation delay
ACS11	10	s	Deactivation delay
ACS12	15	min	Compressor forcing activation delay
ACS13	5	min	Time of subsequent activations of compressors after ACS12
ACS28	240	min	Maximum DHW production duration time
ACS57	2.0	°C	Regulation differential for delivery or return line monitoring
ACS58	7.0	°C	Increase of regulation setpoint for delivery line monitoring
ST19	5.0	°C	With NZ or PID, Heat Pump - Activation zone offset
ST21	2.0	°C	With NZ or PID, Heat Pump - De-activation zone offset
ST26	120	Sec	With ZN or PID, Heat pump - Maximum activation time
ST27	90	Sec	With NZ or PID, Heat Pump - Minimum activation time
ST28	30	Sec	With ZN or PID, Heat Pump - Maximum de-activation time
ST29	10	Sec	With ZN or PID, Heat pump - Minimum de-activation time

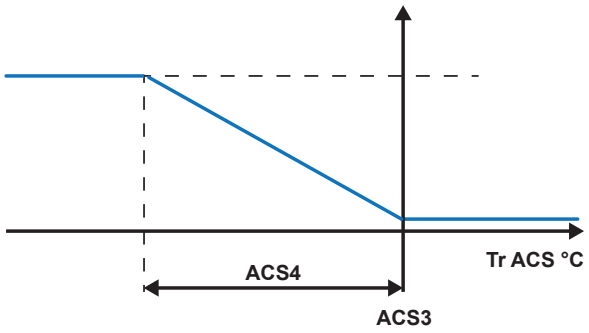


Fig. 30 Compressor activation

In addition to regulating the water temperature measured at the heat exchanger outlet, the controller also includes some override functions to manage the demand of hot domestic water.

If the demand is not fulfilled and all the available power steps are not enabled within the time setpoint in parameter “ACS12”, the controller overrides to the next step.

After the time set in “ACS12” has elapsed, override to the next available steps occurs as soon as the time set in parameter “ACS13” has elapsed.

The override remains active until the temperature setpoint is achieved in the sanitary system.

As soon as the time set in parameter “ACS28” has elapsed, the production of hot water for the sanitary system is stopped, and the unit switches to operation in air conditioning mode.

If the demand persists, the production of hot water for the sanitary system resumes after the time set in parameter “ACS10” has elapsed.

3.19.5 Forced exit from “ACS”

The controller may stop the “ACS” function before a demand is met due to many other conditions than merely exceeding the max. time to fulfil the hot sanitary water demand.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS7	58.0	°C	Forced output set point
ACS8	2.0	°C	Re-enabling diff. from forced output
ACS9	20	min	Minimum cut-off from forced output
ACS29	2	-	DHW forced output alarm due to temperature, maximum number of attempts per hour

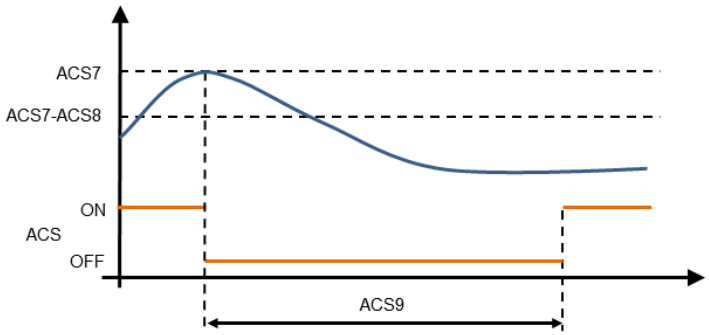


Fig. 31 Management of forced exit from “ACS”

The controller always checks that the output water temperature to the heat exchanger featured in the unit is inferior to the value set in parameter “ACS7”.

If the output water temperature from the heat exchanger in the unit exceeds the value set in parameter “ACS7”, the controller stops the production of hot water for the sanitary circuit in order to prevent the safety devices from tripping, which may even cause the unit to stop.

This stop causes the flow of water to be diverted to the air conditioning system and, where necessary, the compressors to be started in order to fulfil the demand for temperature regulation.

An alarm triggers to warn about the forced stop of water production.

As soon as the water temperature drops by the differential value set in parameter “ACS8”, the alarm is cleared automatically.

The alarm is cleared automatically until the value set in parameter “ACS29” is achieved.

If the alarm triggers again, then it has to be cleared manually.

In any case, water production for the sanitary circuit is resumed after the interval of time set in parameter “ACS9” has elapsed.

If the demand persists, the production of hot water for the sanitary system resumes after the time set in parameter “ACS10” has elapsed.

3.19.6 Time bands for “ACS” function

The controller can manage the hot water production setpoint for the sanitary system according to time bands.

An offset is added to the setpoint that represents the period defined within each time band. If the offset is positive, then the setpoint is increased; if it is negative, the setpoint is reduced.

The setpoint value can in no case exceed its max. value.

The system enables setting 3 time bands and selecting one of the 7 possible combinations for each day in the week.

3.19.7 Defrost management

Defrost is always performed using the inertia of the air conditioning system. This is why the air conditioning system must be enabled to run a defrost cycle.

If it is not, the unit stops and warns about failed defrost.

If the conditions exist to run a defrost cycle during the production of hot water for sanitary use, and the air conditioning system is ON, the unit switches from hot sanitary water production mode to air conditioning mode, after which defrosting gets started.

If the required parameter is enabled, during the defrosting process the controller continues to fulfil the demand from the sanitary system using the external resources available.

After completion of the defrosting cycle, the unit gets ready to fulfil the demand from the air conditioning system.

The unit switches back to the production of hot water for the sanitary system if the demand is still active and after the time set in parameter “ACS10” has elapsed.

3.19.8 Max. setpoint compensation in heating mode

These units are manufactured to produce hot water to be used both for air conditioning and sanitary purposes at very high temperatures.

To prevent damage to the compressors in the event of operation outside their working ranges, the software features a compensation function that is linked to the air temperature and limits the max. setpoint value.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS6	65.0	°C	Maximum Setpoint
ACS25	-10.0	°C	Outside Air - DHW setpoint decrease triggering point
ACS26	-20.0	°C	Outside Air - Minimum limit for DHW setpoint decrease
ACS27	55.0	°C	Outside Air - Maximum setpoint at low temperature
ST6	65.0	°C	Heat Pump - Maximum Setpoint
SD15	-10.0	°C	Operating limit - HP setpoint reduction start point
SD16	-20.0	°C	Operating limit - Minimum outside temperature limit for HP setpoint reduction
SD17	55.0	°C	Operating limit - Maximum setpoint with low outside air temperature

When setting parameters "ACS26" and "SD16", the value of parameter "PAL118", which stops operation of the unit for hot water production, must be taken into consideration.

The values listed in the table are reflected in the graphical representation that shows the change in the max. setpoint relating to both sanitary water “ACS6” and hot water for the air conditioning system “ST6”, as shown in the figure.

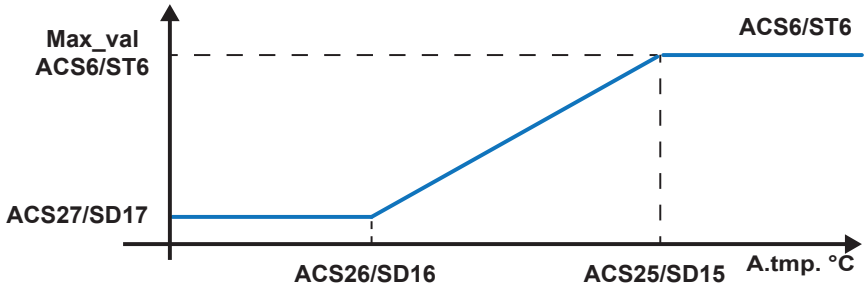


Fig. 32 Change in max. "ACS6" and "ST6" setpoints linked to air temperature change

In the graph, beside the parameters of the function, there are the abbreviations that refer to:

- Max_val ACS67/ST6 = max. value of parameters "ACS6" and "ST6";
- A.tmp = air temperature.

3.19.9 Heater management

The controller can manage a supplementary power step, which may be either a heater or any other source outside the unit.

Depending on the settings, it may be used to supplement the compressor during the production of hot sanitary water or to replace the compressor during the defrost and the anti legionella cycles.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS35	1	-	Enables DHW integration heaters
ACS36	1	-	Enables heaters as an integration to compressors in defrost mode
ACS37	60	s	Switching on time between steps of heaters in defrost mode
ACS38	5	min	Switching on time between steps of heaters in DHW mode
ACS38	0	-	DHW heater alarm management

If the power step is used as a supplement during the production of hot water for sanitary use “ACS35 = 1”, it is enabled as soon as the time set in parameter “ACS38” has elapsed, after 100% compressor capacity is achieved.

If the power step is used for the production of hot water for sanitary use in replacement of the compressor during the defrost cycles “ACS36 = 1”, it is enabled with the “ACS4” differential as soon as the temperature read by the reference hot sanitary water probe drops with respect to the setpoint stored in parameter “ACS3”.

In any case, the controller activates the power step as soon as the time set in parameter “ACS37” has elapsed.

The override remains active until the temperature setpoint is achieved in the sanitary system.

The controller features a digital input that is used to display the alarms linked to the power step.

If the setpoint of parameter "ACS39” is "0" and the input is open, the unit will only display the alarm message; if the setpoint is "1", the unit displays the alarm message and stops the corresponding output.

3.19.10 Anti legionella cycle

The controller can manage an anti legionella cycle while producing hot sanitary water.

The anti legionella cycle requires that hot water be produced in the sanitary circuit at a different setpoint value, i.e. a higher value than the normal working value. The cycle is run one day a week, starting from a preset time, lasting for a min. time and with a max. time given to achieve the required temperature.

The anti legionella cycle is only performed with supplementary power steps.

During the anti legionella cycle the unit continues to work in air conditioning mode, i.e. the 3-way valve diverts the flow of water to the air conditioning system, and fulfils the thermostatic demand, where necessary.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
ACS14	70	°C	Anti-legionella - Set point
ACS15	60	°C	Anti legionella - Minimum Setpoint
ACS16	75	°C	Anti legionella - Maximum Setpoint
ACS17	2	h	Anti-legionella - Time of activation
ACS18	2	-	Anti-legionella - Day of activation
ACS19	3.0	°C	Anti-legionella - Control differential
ACS20	4.0	°C	Anti-legionella - Override
ACS21	5	min	Anti-legionella - Minimum duration
ACS22	15	min	Anti legionella - Maximum duration
ACS23	1	-	Anti-legionella - Enabling

Parameter "ACS18" defines the day in the week when the anti legionella cycle is performed.

Value "0" is Sunday, value "6" is Saturday, and value "7" disables the cycle.

If hot sanitary water is being produced when the anti legionella cycle is supposed to start, the anti legionella cycle is postponed by one week.

To achieve the anti legionella setpoint stored in "ACS14", the controller enables the available resources in a proportional manner within the corresponding differential "ACS19".

As soon as the anti legionella cycle is started, the controller heats the water to a temperature exceeding the value stored in parameter "ACS14" , based on the "override" value set in parameter "ACS20".

For correct performance of an anti legionella cycle, the setpoint must be achieved within the time set in parameter “ACS22” and it must be preserved for the time set in parameter “ACS21”.

If the anti legionella cycle is not performed due to a demand from the sanitary system, or if it is not completed correctly, the controller outputs the corresponding warning message.

3.20 Flowzer

The “Flowzer” function is designed to define the speed setpoints for the pump fitted in the unit that help meet the demand received from different system types.

Specific logics have been developed according to which the controller manages the hydraulic systems connected to the unit.

The management logics are intended to increase system efficiency and save energy for water circulation at the same time.

With the help of these logics, the circulating water fulfils the demands of the system, without exceeding the design flow rate limits and without jeopardising correct operation of the cooling unit.

Each management logic refers to a specific system type and it requires some arrangements both at the time of installation and at start-up.

The parameters involved with this function are shown below.

Parameter	Min	Max	UM	Description
FMG1	0.0	100.0	%	Common - Min. pump speed
FMG2	0.0	100.0	%	Common - Max. pump speed
FMG4	0.0	100.0	%	Common - Pump speed at start-up
FMG5	10	999	s	Common - Pump start-up time
FMG6	0.0	15.0	°C	DT/VPS - Setpoint
FMG7	0.0	15.0	°C	DT/VPS - Neutral zone
FMG9	0.0	100.0	%	Common - Setup parameter - Pump speed increase %
FMG10	1	999	s	Common - Setup parameter - Time between pump speed increases
FMG11	0.0	100.0	%	Common - Setup parameter - Pump speed decrease %
FMG12	1	999	s	Common - Setup parameter - Time between pump speed decreases
FMG13	0.0	100.0	%	Common - Emergency - LΔp / HΔp - % increase/decrease
FMG14	0	999	s	Common - Emergency - LΔp / HΔp - Time between increase/decrease
FMG15	6.0	100.0	°C	VPS - Setup parameter - Setpoint of second pump speed increase threshold
FMG16	1	999	s	VPS - Setup parameter - Second threshold - Increase time
FMG18	0	10000	-	PID - Coefficient - Kp
FMG19	0	10000	-	PID - Coefficient - Ki
FMG20	0	10000	-	PID - Coefficient - Kd
FMG42	0	1	-	Common - Pump in manual mode
FMG43	0.0	999.0	kPa	VD/VDE/VFPP - Cooling - System - Pressure difference threshold
FMG44	0.0	999.0	kPa	VD/VDE/VFPP - Cooling - System - Differential
FMG45	0.0	999.0	kPa	VD/VDE/VFPP - Heating - System - Pressure difference threshold
FMG46	0.0	999.0	kPa	VD/VDE/VFPP - Heating - System - Differential
FMG47	10	9999	l	VFPP - Cooling - Volume in litres
FMG48	10	9999	l	VFPP - Heating - Volume in litres
FMG52	0	1	-	VFPP - Through time
FMG53	1	999	s	VFPP - Through time in manual mode
FMG54	50.0	100.0	%	Common - Pump - Speed in manual mode
FMG55	0.0	100.0	%	VFPP/DT - Valve - Min. opening
FMG56	0.0	100.0	%	VFPP/DT - Valve - Max. opening
FMG57	0.0	100.0	%	VFPP/DT - Valve - Open in manual mode
FMG58	0	100	%	VFPP/DT - Valve - Min. opening with temp. diff. in heat exchanger smaller than min. value
FMG59	0.0	100.0	%	VFPP/DT - Valve - Setup parameter - % increase
FMG60	1	999	s	VFPP/DT - Valve - Setup parameter - Time between increases
FMG61	0.0	100.0	%	VFPP/DT - Valve - Setup parameter - % decrease
FMG62	1	999	s	VFPP/DT - Valve - Setup parameter - Time between decreases
FMG63	0	1	-	VFPP/DT - Valve - Open in manual mode
FMG64	0.0	100.0	%	VP - Cooling - Inverter pump %
FMG65	0.0	100.0	%	VP - Free Cooling - Inverter pump %
FMG66	0.0	100.0	%	VP - Heating - Inverter pump %
PA22	0	999	kPa	User - Flowzer - Low pressure difference setpoint in heat exchanger
PA55	0	999	kPa	User - Flowzer - Pressure difference high in heat exchanger

Provision has been made for screens in units featuring this function which show the operating status. The main parameters can also be accessed from the screens of the “Flowzer” function, in addition to the “Parameters” menu.

If access is gained with a user level password, the parameters featured are only in view mode.

Below is a list of the available screens when access is gained through the “Flowzer” icon.

The screen shows the type of system managed by the unit controller.

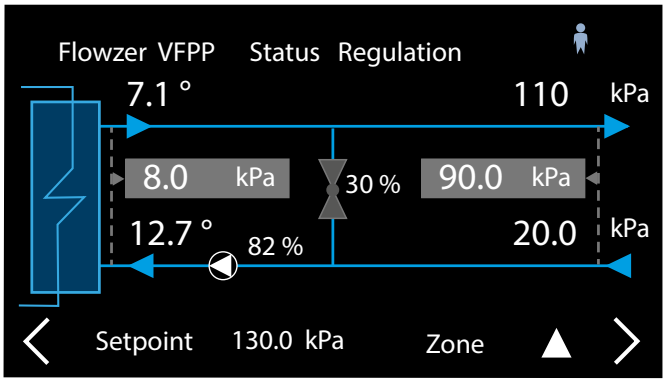


Fig. 33 “VFPP” function screen

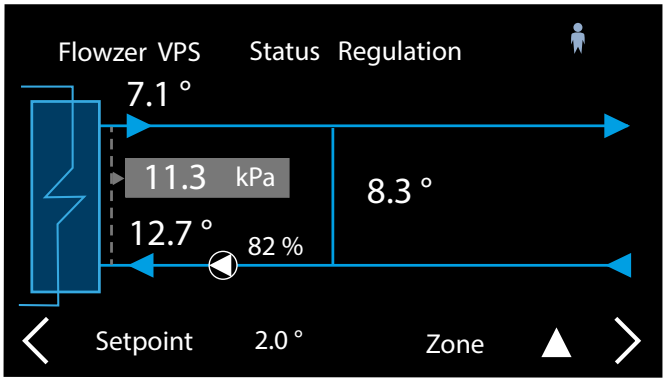


Fig. 34 “VPS” function screen

The various setup parameters are illustrated in the next sections.

3.20.1 General

All functions have some parameters in common which are used to control the pump fitted in the unit.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG1	50.0	%	Common - Min. pump speed
FMG2	100.0	%	Common - Max. pump speed
FMG4	75.0	%	Common - Pump speed at start-up
FMG5	45	s	Common - Pump start-up time
FMG42	0	-	Common - Pump in manual mode
FMG54	72.0	%	Common - Pump - Speed in manual mode

As regards all Flowzer-related functions, the pump in the unit always gets started at the percentage setpoint stored in parameter “FMG4” in order to detect the operating values and determine what the system needs. The start-up speed is maintained for as long as the time set in parameter “FMG5”.

After the start-up time has elapsed, the controller manages the pump speed according to the enabled function.

Irrespective of the enabled function, the pump can be overridden to manual operation at any time by setting the value in parameter “FMG42” to “1” (“0” = automatic operation).

When operation is overridden to manual mode, the pump runs at the speed percentage set in parameter “FMG54”.

Some of the many featured functions require the installation of pressure probes in both the delivery and return lines to/from the system, a differential pressure probe on the heat exchanger side fitted in the unit and a temperature probe on the bypass pipe.

If one of the above-mentioned probes is alarmed, which causes the setup references to be lost, the controller overrides the pump to manual mode at the speed setpoint stored in parameter “FMG54”.

If a bypass valve is fitted, this one too is overridden to the opening required in manual mode, as set in parameter “FMG57”.

For operational continuity, it is important that the values set in parameters “FMG54” and “FMG57” are consistent so that the system is also operational when one of the probes used by the “Flowzer” function is alarmed.

3.20.2 “VP” function

The “VP” function requires that the pump operates at constant speed, which is made possible by the inverter fitted to control it.

The pump speed must be set up to achieve the system rated flow.

This function is useful when the flow rate of the pump aboard the unit is higher than the rated flow. The result of flow rate reduction is energy consumption saving.

The reduction of the pump speed is set as a percentage value of the nominal speed.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG64	75.0	%	VP - Cooling - Inverter pump %
FMG65	85.0	%	VP - Free Cooling - Inverter pump %
FMG66	72.0	%	VP - Heating - Inverter pump %

The controller is designed to set different speeds according to the type of unit and the active function.

The speed values can be viewed and edited in the screens of the Flowzer menu, as well as in the parameters listed in the table.

3.20.3 “DT” function

The “DT” function is designed to change the pump speed in order to have a constant temperature difference between the unit inlet and outlet.

The resulting effect is that the temperature of water supplied to the system is constant. When the load is reduced, the water flow rate is reduced accordingly, which results in consumption saving.

The controller keeps the flow rate through the unit within a range of safety values in order to preserve it in good operating condition.

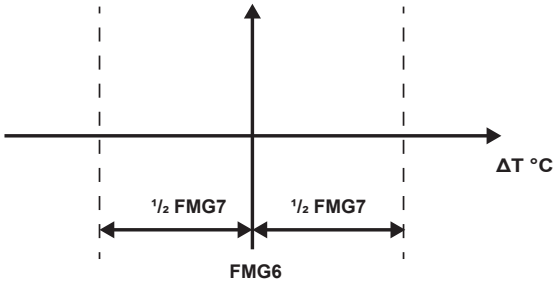
This function may be applied to different types of system, their main difference consisting in a bypass valve or a pump being fitted in the secondary circuit. The parameters in the controller depend in any case on the factory-enabled functions.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG6	6.0	°C	DT/VPS - Setpoint
FMG7	0.5	°C	DT/VPS - Neutral zone
FMG13	5.0	%	Common - Emergency - LΔp / HΔp - % increase/decrease
FMG14	10	s	Common - Emergency - LΔp / HΔp - Time between increase/decrease
FMG18	300	-	PID - Coefficient - Kp
FMG19	150	-	PID - Coefficient - Ki
FMG20	5	-	PID - Coefficient - Kd
FMG55	0.0	%	VFPP/DT - Valve - Min. opening
FMG56	100.0	%	VFPP/DT - Valve - Max. opening
FMG57	30.0	%	VFPP/DT - Valve - Open in manual mode
FMG58	50	%	VFPP/DT - Valve - Min. opening with temp. diff. in heat exchanger smaller than min. value
FMG59	1.0	%	VFPP/DT - Valve - Setup parameter - % increase
FMG60	35	s	VFPP/DT - Valve - Setup parameter - Time between increases
FMG61	2.0	%	VFPP/DT - Valve - Setup parameter - % decrease
FMG62	10	s	VFPP/DT - Valve - Setup parameter - Time between decreases
FMG63	0	-	VFPP/DT - Valve - Open in manual mode
PA22	8	kPa	User - Flowzer - Low pressure difference setpoint in heat exchanger
PA55	70	kPa	User - Flowzer - Pressure difference high in heat exchanger

Below is a graphical representation of the parameters set based on the setpoint difference.



The controller adjusts the pump speed to keep constant the temperature difference, which is the setpoint value in parameter “FMG6”.

The setpoint is associated to a neutral zone that is set in parameter “FMG7”.

Outside the neutral zone the controller modulates the pump speed according to the setpoints stored in the PID parameters.

If the function is not designed to manage other features than temperature difference control on the heat exchanger side fitted in the unit, the hydraulic diagram of the installation is approximately as follows.

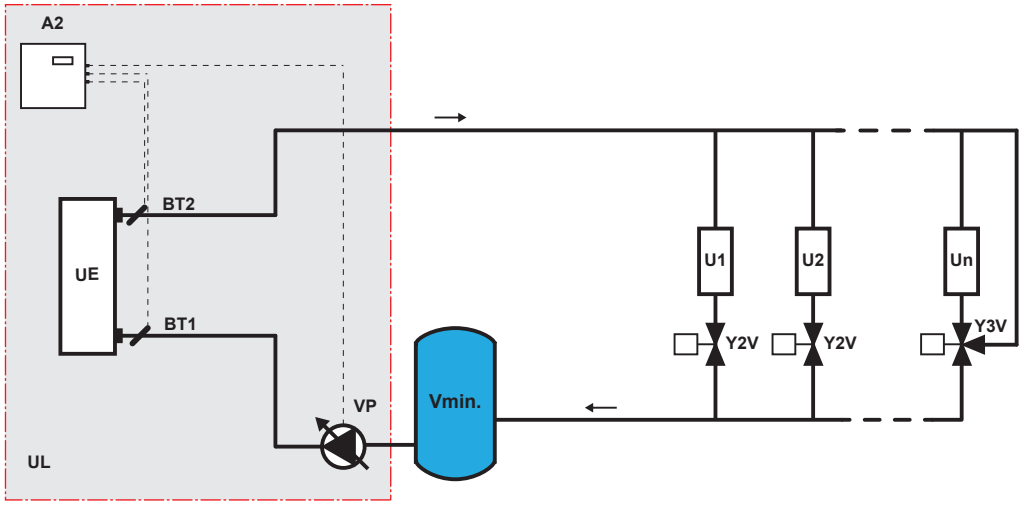


Fig. 35 Pump in unit used for water circulation in the system

If the function is designed for flow rate control on the heat exchanger side fitted in the unit, the hydraulic diagram of the installation is approximately as follows.

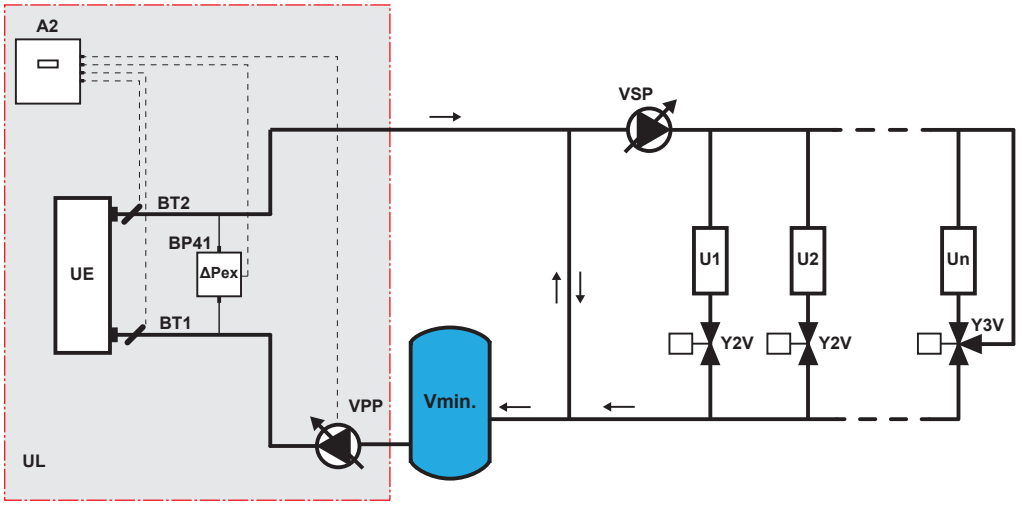


Fig. 36 System featuring one pump in primary circuit and one in secondary circuit

In this case, irrespective of the temperature difference value measured on the heat exchanger side, the controller provides for the pump speed required to keep the pressure difference between the values set in parameters “PA22” and “PA55”.

If the pressure difference on the heat exchanger side is outside the range of values set in parameters “PA22” and “PA55”, the controller changes the pump speed as needed using the setpoints in parameters “FMG13” and “FMG14”.

If the function requires management of a bypass valve to control the pressure difference on the heat exchanger side, the hydraulic diagram of the installation is approximately as follows.

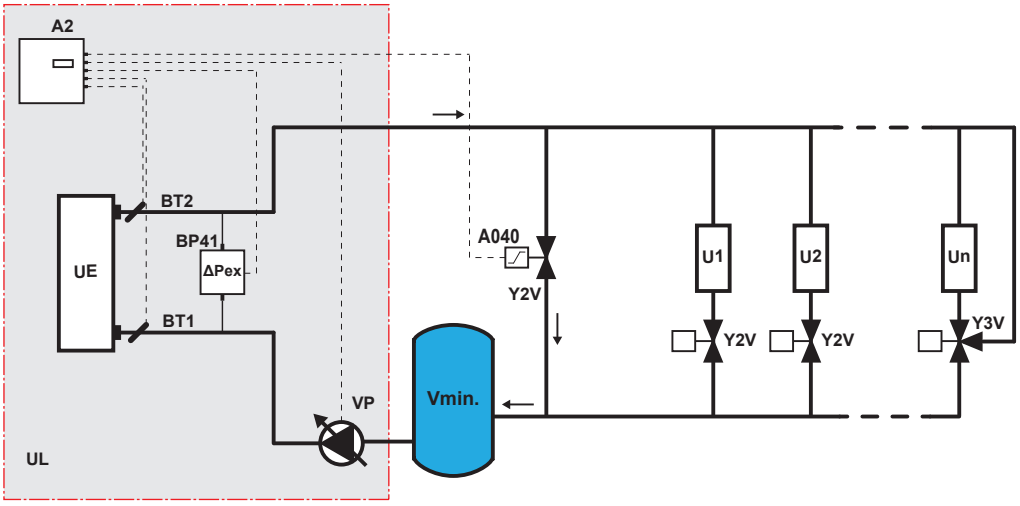


Fig. 37 Pump in unit used for water circulation in the system with bypass valve

If the pressure difference on the heat exchanger side is lower than the value in parameter “PA22”, the controller opens the bypass valve at the percentage setpoint (pre-positioning) stored in parameter “FMG58”.

When in start position or during setup operations, the controller uses the setpoints in parameters “FMG59” and “FMG60” if it senses the need to open the bypass valve.

If the pressure difference on the heat exchanger side is higher than the setpoint in parameter “PA55”, the controller uses the values set in parameters “FMG61” and “FMG62” to reduce it.

The bypass valve may be overridden to open at any time by setting the value of parameter “FMG63” to “1” in order to enable manual mode (“0” = automatic mode).

When operation is overridden to manual mode, the valve opens at the percentage set in parameter “FMG57”.

Irrespective of the setpoint, the controller manages opening of the bypass valve between the min. value set in parameter “FMG55” and the max. value set in parameter “FMG56”.

3.20.4 “VDE” function

The “VDE” function is designed to set the pump speed in order to have a constant pressure difference between the unit inlet and outlet.

The speed of the pump is set automatically to preserve the desired flow through the heat exchanger in the unit.

This function is useful when the head of the pump aboard the unit is greater than the system requires, which would result in a higher water flow circulating.

The value corresponding to the difference between the input and the output pressure needs to be monitored to ensure the correct water flow.

In heat pump units the controller is designed to offer the opportunity to set two pressure difference values: one for cooling and one for heating.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG43	130.0	kPa	VD/VDE/VFPP - Cooling - System - Pressure difference threshold
FMG44	2.0	kPa	VD/VDE/VFPP - Cooling - System - Differential
FMG45	130.0	kPa	VD/VDE/VFPP - Heating - System - Pressure difference threshold
FMG46	2.0	kPa	VD/VDE/VFPP - Heating - System - Differential

The controller adjusts the pump speed so as to keep constant the pressure difference, which is the setpoint value in parameter “FMG43”, for operation in cooling mode.

The value is adjusted taking as reference the differential set in parameter “FMG44”.

If the unit is a heat pump unit, the controller adjusts the pump speed in heating mode so as to keep constant the pressure difference, which is the setpoint value in parameter “FMG45”.

In heating mode the value is adjusted taking as reference the differential set in parameter “FMG46”.

Differentials work underneath and above the setpoint. The PID parameters are used to keep the setpoint.

The hydraulic diagram below shows a system featuring this function.

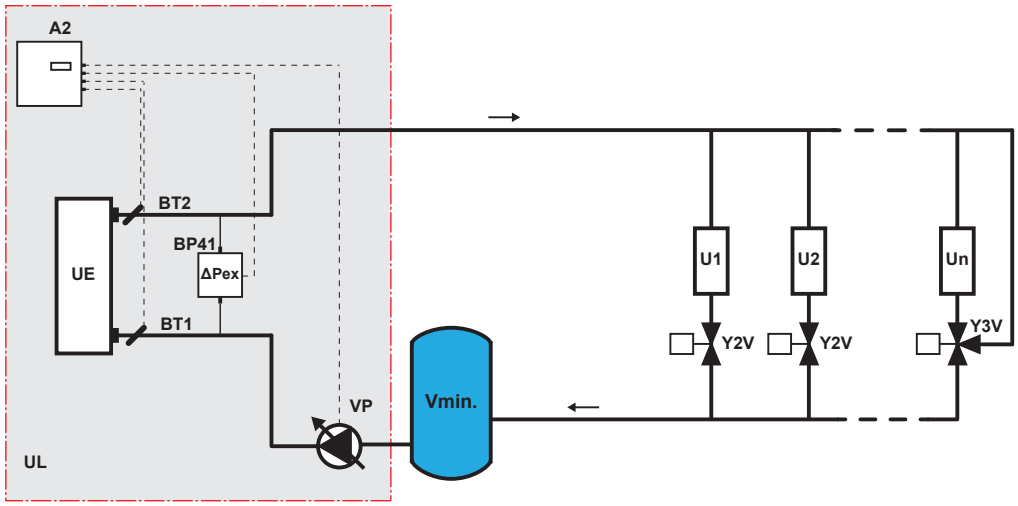


Fig. 38 System diagram with constant pressure control in unit

3.20.5 “VD” function

The “VD” function is designed to set the pump speed in order to have a constant pressure difference between the delivery and the return lines in the system.

If the pressure difference at the ends of the system is kept constant, the pump speed is set automatically in order to have the desired flow as the load changes.

A reduction in the load demand results in an increase in the pressure difference that the controller offsets by reducing the pump speed, which has an impact in terms of energy consumption saving.

In heat pump units the controller is designed to offer the opportunity to set two pressure difference values: one for cooling and one for heating.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG18	300	-	PID - Coefficient - Kp
FMG19	150	-	PID - Coefficient - Ki
FMG20	5	-	PID - Coefficient - Kd
FMG43	130.0	kPa	VD/VDE/VFPP - Cooling - System - Pressure difference threshold
FMG44	2.0	kPa	VD/VDE/VFPP - Cooling - System - Differential
FMG45	130.0	kPa	VD/VDE/VFPP - Heating - System - Pressure difference threshold
FMG46	2.0	kPa	VD/VDE/VFPP - Heating - System - Differential

The controller adjusts the pump speed so as to keep constant the pressure difference, which is the setpoint value in parameter “FMG43”, for operation in cooling mode.

The value is adjusted taking as reference the differential set in parameter “FMG44”.

If the unit is a heat pump unit, the controller adjusts the pump speed in heating mode so as to keep constant the pressure difference, which is the setpoint value in parameter “FMG45”.

In heating mode the value is adjusted taking as reference the differential set in parameter “FMG46”.

Differentials work underneath and above the setpoint. The PID parameters are used to keep the setpoint.

The hydraulic diagram below shows a system featuring this function.

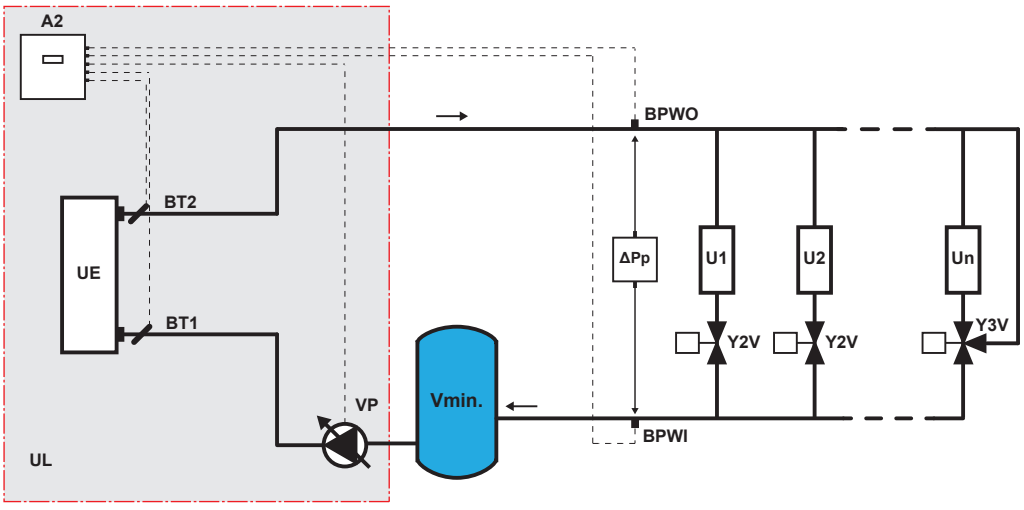


Fig. 39 System diagram with constant pressure control in system

3.20.6 “VFPP” function

The “VFPP” function is designed to control variable flow systems to the primary circuit.

As demand changes, the system keeps stable the difference in water pressure and temperature in the system delivery line.

The water flow rate and temperature are independent variables and they are not directly connected.

Pump control (only one pump in the system) provides for the necessary flow rate, while cooling capacity control ensures the correct temperature.

A reduction in the demand from the system results in an increase in the pressure difference that the controller offsets by reducing the pump speed, which has an impact in terms of energy consumption saving.

The water flow rate in the primary circuit is always adjusted within the set limits for correct operation of the refrigerant unit.

In heat pump units the controller is designed to offer the opportunity to set two pressure difference values: one for cooling and one for heating.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG9	2.0	%	Common - Setup parameter - Pump speed increase %
FMG10	40	s	Common - Setup parameter - Time between pump speed increases
FMG11	1.0	%	Common - Setup parameter - Pump speed decrease %
FMG12	35	s	Common - Setup parameter - Time between pump speed decreases
FMG13	5.0	%	Common - Emergency - LΔp / HΔp - % increase/decrease
FMG14	10	s	Common - Emergency - LΔp / HΔp - Time between increase/decrease
FMG43	130.0	kPa	VD/VDE/VFPP - Cooling - System - Pressure difference threshold
FMG44	2.0	kPa	VD/VDE/VFPP - Cooling - System - Differential
FMG45	130.0	kPa	VD/VDE/VFPP - Heating - System - Pressure difference threshold
FMG46	2.0	kPa	VD/VDE/VFPP - Heating - System - Differential
FMG47	700	l	VFPP - Cooling - Volume in litres
FMG48	700	l	VFPP - Heating - Volume in litres
FMG52	0	-	VFPP - Through time
FMG53	30	s	VFPP - Through time in manual mode
FMG55	0.0	%	VFPP/DT - Valve - Min. opening
FMG56	100.0	%	VFPP/DT - Valve - Max. opening
FMG57	30.0	%	VFPP/DT - Valve - Open in manual mode
FMG58	50	%	VFPP/DT - Valve - Min. opening with temp. diff. in heat exchanger smaller than min. value
FMG59	1.0	%	VFPP/DT - Valve - Setup parameter - % increase
FMG60	35	s	VFPP/DT - Valve - Setup parameter - Time between increases
FMG61	2.0	%	VFPP/DT - Valve - Setup parameter - % decrease
FMG62	10	s	VFPP/DT - Valve - Setup parameter - Time between decreases
FMG63	0	-	VFPP/DT - Valve - Open in manual mode
PA22	8	kPa	User - Flowzer - Low pressure difference setpoint in heat exchanger
PA55	70	kPa	User - Flowzer - Pressure difference high in heat exchanger

The controller adjusts the pump speed so as to keep constant the pressure difference in the system, which is the setpoint value in parameter “FMG43”, for operation in cooling mode.

The value is adjusted taking as reference the differential set in parameter “FMG44”.

If the unit is a heat pump unit, the controller adjusts the pump speed in heating mode so as to keep constant the pressure difference in the system, which is the setpoint value in parameter “FMG45”.

In heating mode the value is adjusted taking as reference the differential set in parameter “FMG46”.

Differentials work underneath the setpoint.

The speed is increased by small percentage variations at preset intervals of time using the values stored in parameters “FMG9” and “FMG10”. Speed reduction takes place in the same way, but referencing the setpoints in parameters “FMG11” and “FMG12”.

If the pressure difference on the heat exchanger side in the unit during the process to keep the pressure difference in the system constant is lower than the value in parameter “PA22”, the controller opens the bypass valve at the percentage setpoint (pre-positioning) stored in parameter “FMG58”.

When in start position or during setup operations, the controller uses the setpoints in parameters “FMG59” and “FMG60” if it senses the need to open the bypass valve any further.

Opening of the bypass valve makes it possible to circulate the necessary flow to keep the pressure difference constant on the heat exchanger side fitted in the unit.

The bypass valve starts closing again when the pressure difference on the heat exchanger side is higher than the value stored in parameter “PA22” plus the differential value. The differential value is written in the programming code.

If the pressure difference on the heat exchanger side during the process to keep the pressure difference constant in the system is higher than the setpoint in parameter “PA55”, the controller uses the values set in parameters “FMG61” and “FMG62” to reduce it.

The bypass valve may be overridden to open at any time by setting the value of parameter “FMG63” to “1” in order to enable manual mode (“0” = automatic mode).

When operation is overridden to manual mode, the valve opens at the percentage set in parameter “FMG57”.

Irrespective of the setpoint, the controller manages opening of the bypass valve between the min. value set in parameter “FMG55” and the max. value set in parameter “FMG56”.

Special conditions may exist where automatic setup of the pump speed needs to be bypassed.

If the value of parameter “FMG52” is set to “1”, the time elapsing between two pump speed changes is activated according to the value in parameter "FMG53".

The hydraulic diagram below shows a system featuring this function.

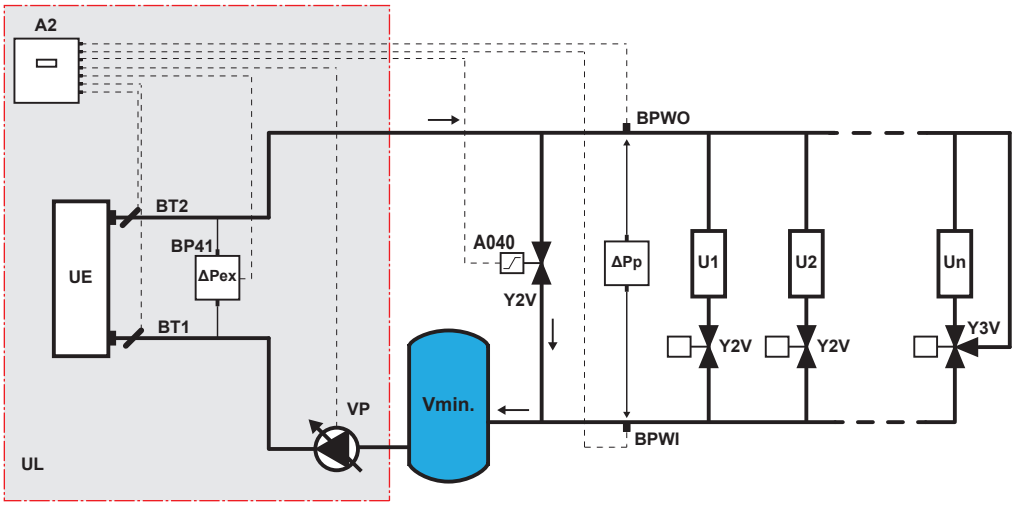


Fig. 40 System diagram with “VFPP” control

3.20.7 “VPS” function

The “VPS” function is designed for flow rate modulation to the primary circuit following that of the secondary circuit, having as reference the water temperature difference measured between the outlet of the primary circuit and the bypass pipe.

The water flow rate in the primary circuit is always set up within the limits set for correct operation of the refrigerant unit.

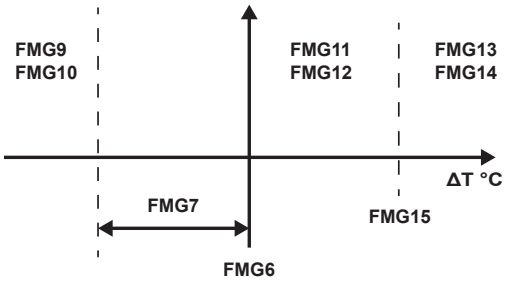
The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
FMG6	5.0	°C	DT/VPS - Setpoint
FMG7	0.5	°C	DT/VPS - Neutral zone
FMG9	2.0	%	Common - Setup parameter - Pump speed increase %
FMG10	40	s	Common - Setup parameter - Time between pump speed increases
FMG11	1.0	%	Common - Setup parameter - Pump speed decrease %
FMG12	35	s	Common - Setup parameter - Time between pump speed decreases
FMG13	5.0	%	Common - Emergency - LΔp / HΔp - % increase/decrease
FMG14	10	s	Common - Emergency - LΔp / HΔp - Time between increase/decrease
FMG15	15.0	°C	VPS - Setup parameter - Setpoint of second pump speed increase threshold
FMG16	5	s	VPS - Setup parameter - Second threshold - Increase time

The controller adjusts the pump speed to keep the difference in the water temperature at the outlets of the primary circuit and the bypass pipe at the setpoint stored in parameter “FMG6”.

A graphical representation is shown below.



As the graph shows, the neutral zone is underneath the setpoint in parameter “FMG7”.

Underneath the neutral zone the pump speed is reduced taking small percentage variations - this value is set in parameter “FMG11” - which take place with the delay time set in parameter “FMG12”.

Above the neutral zone the pump speed is increased taking small percentage variations - this value is set in parameter “FMG11” - which take place with the delay time set in parameter “FMG12”.

If the temperature difference reaches the value set in parameter “FMG15”, the pump speed is increased with the percentage variations set in parameter “FMG13”, which takes place with the delay time set in parameter “FMG14”.

The hydraulic diagram below shows a system featuring this function.

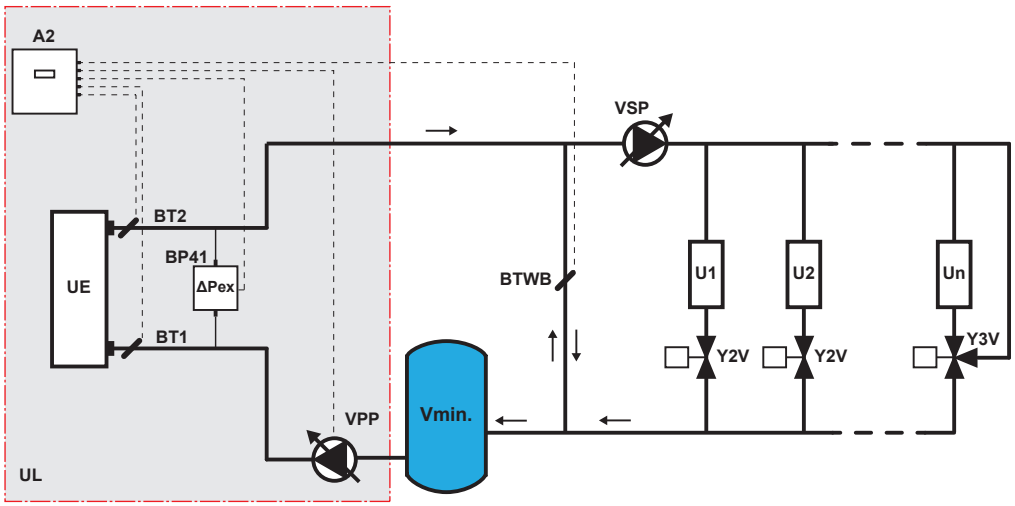


Fig. 41 System diagram with “VPS” control

3.21 SMART Link

The "SMART Link" function prepares the refrigerant units for serial connection with "GOLD" ventilated units.

Through the serial connection, the "GOLD" unit intervenes in the water temperature value of the refrigerant unit to optimize system operation and reduce energy consumption.

This function is available for both chiller units and heat pump units.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
SP6	0	1	-	Enable BMS supervision writings
SP11	0	1	-	Enabling of SmartLink BMS
SP12	1	247	-	BMS serial address
SP14	0	3	-	Modbus speed

For serial connection and networked operation of the two units, also consult the documentation for the GOLD unit.

3.21.1 Parametrization of the controller

Normally, in units that have the "SMART Link" function, the parameters for serial communication in the controller are factory set.

If a check is necessary, the correct values are shown in the table.

Parameter	Value	UM	Description
SP6	1	-	Enable BMS supervision writings
SP11	1	-	Enabling of SmartLink BMS
SP12	64	-	BMS serial address
SP14	3	-	Modbus speed

When these parameters are correctly set, the “SmartLink” symbol appears in the controller display.

If, for any reason, it is necessary to start the refrigerant unit without the command from the "GOLD" unit, parameters SP6 and SP11 must be set to "0".

3.21.2 Serial connection

Serial connection between the refrigerant unit and the "GOLD" unit is to be carried out by the installer and must be done on the serial port RS485 of the controller at terminals 97, 98 and 99, respectively corresponding to (-), (+) and (GND).

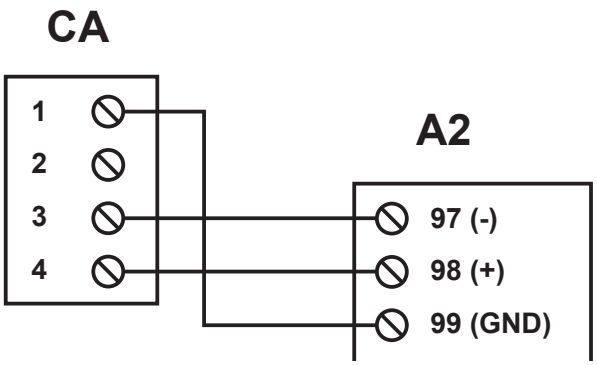


Fig. 42 Serial connection

The abbreviations shown in the illustration refer to:

- CA = cable adapter, present in the GOLD unit;
- A2 = terminal board of the serial port RS485 present in the board of the controller.

The serial connection must be made with AWG20 twisted cable (cross-section of at least 0.5 mm2), for a maximum length of 100 metres.

Adopt suitable precautions to prevent the creation of electromagnetic interference to the connection.

In particular, to avoid creating line interference that would compromise the signal, avoid running the serial cable alongside the power cables.

3.22 SMART Link DX

The “SMART Link DX” function prepares the refrigerant units for serial connection with “GOLD” ventilated units.

The serial connection makes it possible for the “GOLD” unit to determine the value of the power demand of the refrigerant unit in order to optimize system operation and to reduce energy consumption.

This function is available for both cooling only units and for reversible units.

Each “GOLD” unit can control up to 4 refrigerant units. The “GOLD” unit recognises refrigerant units via the value in parameter “SP12”.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
SP6	0	1	-	Enable BMS supervision writings
SP9	0	2	-	Selection type: chiller / heat pump
SP12	1	247	-	BMS serial address
SP14	0	3	-	Modbus speed
SML35	0	1	-	SMARTLink DX - Enable
SML36	0.0	100.0	%	SMARTLink DX - Power required for next unit activation
SML37	0.0	100.0	%	SMARTLink DX - Power required for unit de-activation
SML38	0	999	l/s	SMARTLink DX - Min. air flow rate threshold in normal operation
SML39	0	999	l/s	SMARTLink DX - Min. air flow rate threshold during defrost cycle
SML40	0	999	l/s	SMARTLink DX - Differential required to reset unit after low air flow rate
SML41	0	999	s	SMARTLink DX - Delays in low air flow rate alarm
SML42	0	60	-	SMARTLink DX - Low air flow rate: max. no. alarms per hour
SML43	0	999	s	SMARTLink DX - Delay in offline alarm

3.22.1 Parametrization of the controller

Normally, in units that have the “SMART Link DX” function, the parameters for serial communication in the controller are factory set.

If a check is necessary, the correct values are shown in the table.

Parameter	Value	UM	Description
SP6	1	-	Enable BMS supervision writings
SP9	0	-	Selection type: chiller / heat pump
SP12	64	-	BMS serial address
SP14	3	-	Modbus speed
SML35	1	-	SMARTLink DX - Enable

When these parameters are correctly set, the “SmartLink” symbol appears in the controller display.

Whenever the need arises, in connection with machine management, to disable the SmartLink DX function and to enable control via a 0-10V signal, refer to the section titled “Switching from Smart Link DX to 0/10V”.

The parameters involved are shown below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO40	20	%	Inverter - Minimum speed inverter
SML36	85.0	%	SMARTLink DX - Power required for next unit activation
SML37	35.0	%	SMARTLink DX - Power required for unit de-activation
SML38	550	l/s	SMARTLink DX - Min. air flow rate threshold in normal operation
SML39	880	l/s	SMARTLink DX - Min. air flow rate threshold during defrost cycle
SML40	50	l/s	SMARTLink DX - Differential required to reset unit after low air flow rate
SML41	30	s	SMARTLink DX - Delays in low air flow rate alarm
SML42	2	-	SMARTLink DX - Low air flow rate: max. no. alarms per hour
SML43	20	s	SMARTLink DX - Delay in offline alarm

The refrigerant unit is activated when the demand from the “GOLD” unit is greater than the setpoint in parameter “CO40”.

Where multiple refrigerant units are connected, the next unit is activated when the demand from the “GOLD” unit is greater than the setpoint in parameter “SML36”.

The refrigerant unit stops when the demand from the “GOLD” unit is smaller than the setpoint in parameter “SML37”.

During operation the controller of the refrigerant unit reads the air flow rate of the “GOLD” unit via serial communication and compares the value with the min. threshold setpoints.

If the air flow rate of the “GOLD” unit during normal operation is lower than the setpoint in parameter “SML38”, the controller stops the refrigerant unit after the delay setpoint value in parameter “SML41” and starts alarm “AL153”.

The unit is automatically restarted as soon as the air flow rate of the “GOLD” unit is greater than the sum of the setpoints in parameters “SML38” and “SML40”. The unit is restarted automatically for as many times per hour as specified in parameter “SML42”, after which the alarm needs to be cleared manually to restart the refrigerant unit.

If the air flow rate of the “GOLD” unit during the defrosting cycle is lower than the setpoint in parameter “SML39”, the controller stops the refrigerant unit after the delay setpoint in parameter “SML41” and starts alarm “AL154”.

In this case too, the unit is automatically restarted as soon as the air flow rate of the “GOLD” unit is greater than the sum of the setpoints in parameters “SML38” and “SML40”.

If serial communication between the controller of the refrigerant unit and the “GOLD” unit fails for longer than the setpoint in parameter “SML43”, unit operation is stopped and alarm message “AL156” appears. Alarm “AL156” is always cleared automatically as soon as serial communication is restored.

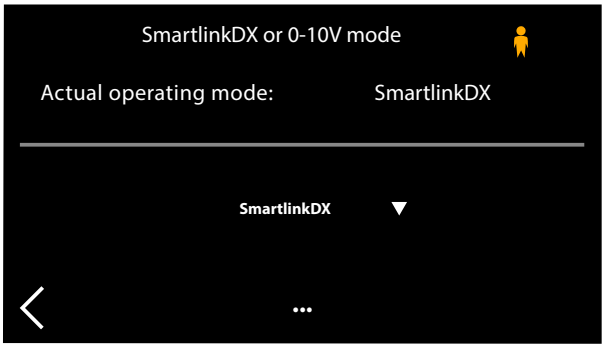
3.22.2 Switching from Smart Link DX to 0/10V

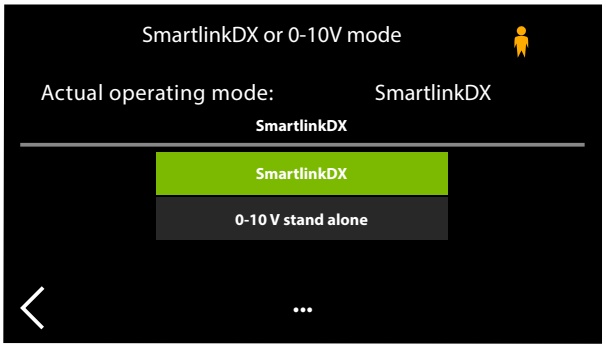
The section above illustrates how to disable the Smart Link DX function and how to enable control via a 0-10V signal, including editing of some parameters.

This shift in control can also be carried out automatically via the user interface.

After accessing the relevant password-protected menus with a “Service” or “Maintenance” profile, a click on the right-hand arrow gives access to the screen featuring the “Smartlink DX / 0/10V signal mode” function.

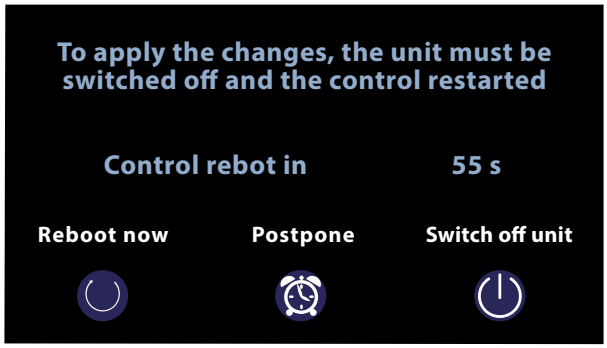
A tap on the icon gives access to the screen showing the operating mode on the top area. Select the wording on the bottom part to change the operating mode.





After a new operating mode has been selected, a screen appears asking the user to restart the controller. Restarting is required to activate the new selection.

When switching from “0/10 V” to “Smart Link DX” mode, the unit needs to be stopped. In this case, a button appears on screen which is pressed to stop unit operation.



3.22.3 Serial connection

Serial connection between the refrigerant unit and the “GOLD” unit is to be carried out by the installer and must be done on the serial port RS485C of the controller at terminals 103, 104 and 105, which respectively correspond to (GND), (+) and (-).

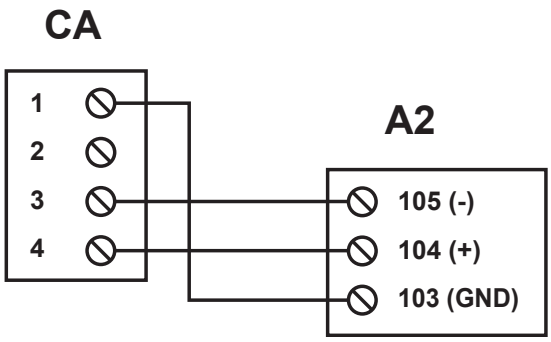


Fig. 43 Serial connection

The abbreviations shown in the illustration refer to:

- CA = cable adapter, present in the GOLD unit;
- A2 = terminal board of the serial port RS485 present in the board of the controller.

The serial connection must be made with AWG20 twisted cable (cross-section of at least 0.5 mm2), for a maximum length of 100 metres.

Adopt suitable precautions to prevent the creation of electromagnetic interference to the connection.

In particular, to avoid creating line interference that would compromise the signal, avoid running the serial cable alongside the power cables.

3.23 SMARTLink +

The “SMARTLink+” function is designed to set up the refrigerant units for connection to as many as ten ventilating units of any version whatsoever (“GOLD” units and chilled beam systems) using an Ethernet port.

The Ethernet connection enables multiple ventilating units to be involved in the definition of the water temperature value of the refrigerant unit with a view to optimizing system operation and reducing energy consumption.

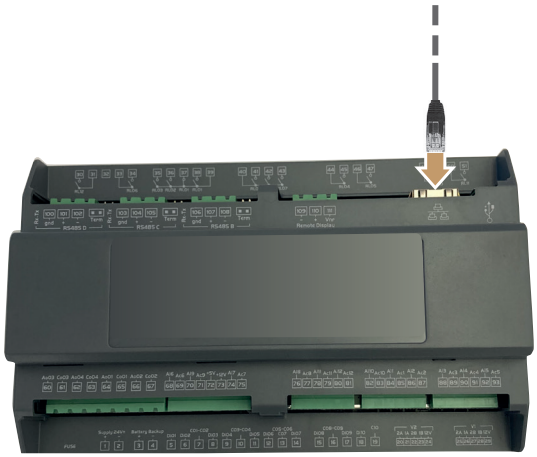
This function offers refrigerant units the possibility to be fitted in systems with either one or two hydraulic circuits (defined as “circuit A” and “circuit B” in the controller parameters).

When the function is enabled in the controller display, the “SmartLink” symbol appears near the setpoint value.

3.23.1 Serial connection

The connection of the refrigerant unit and the ventilating units is via Modbus on a TCP/IP network.

A twisted pair network cable, CAT5, with RJ45 connector must be used for unit connection to the network. The cable may be shielded or not.



There are three possible connection options:

- direct, between a refrigerant unit and a ventilating unit;
- using a specific network for the system where only refrigerant and ventilating units are fitted;
- using the network of the installation where other devices are connected in addition to the system units.

The first case requires that the connection to the connectors is criss-crossed; the other two cases require a direct connection (also see the reference Smart Link+ guide for “GOLD” units.)

3.23.2 Function activation

Normally, units featuring the SMART Link+ function are shipped from the factory with one ventilating unit configured.

When it is started up, the refrigerant unit looks for a ventilating unit in the network whose address is IP 10.2.3.51. If the ventilating unit is not connected or its IP address is different, alarm AL386 appears.

The correct parameters for the type of system in which the unit is connected hydraulically must be set up in the controller of the refrigerant unit.

These parameters include, in sequence:

- the number of ventilating units to be controlled;
- the operating mode switch type (for heat pump units only);
- their IP address;
- the hydraulic circuit to which the ventilating units are connected (“A” is the default factory setpoint);
- activation of serial communication with the ventilating unit.

These values may be set in the “SML” parameters stored in the “Service” branch or in the function-specific screens.

Please find below a list of values set in the “SML” parameters:

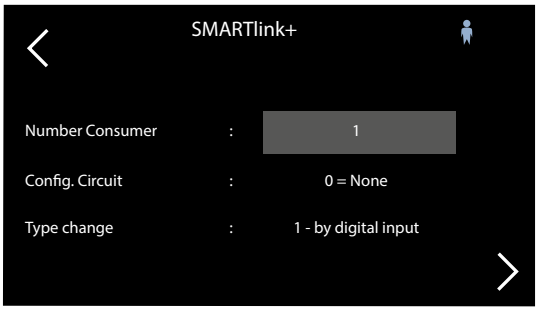
- parameter “SML1” is used to set the number of ventilating units featured;
- the hydraulic circuit to which each ventilating unit is connected is set in parameter SML2: 0 = None; 1 = Circuit A; 2 = Circuit B
- the type of user connected is set from parameter “SML13” to “SML22”: 0 = "Gold"; 1 = "SuperWise"

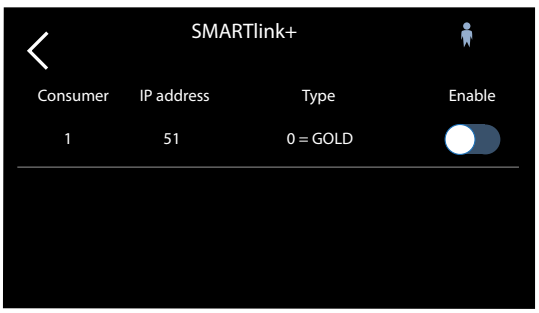
Parameter	Min	Max	UM	Description
SML1	0	10	-	Number of users to be controlled
SML2	0	2	-	Circuit configured
SML3	1	254	-	User 1 - IP address
SML4	1	254	-	User 2 - IP address
SML5	1	254	-	User 3 - IP address
SML6	1	254	-	User 4 - IP address
SML7	1	254	-	User 5 - IP address
SML8	1	254	-	User 6 - IP address
SML9	1	254	-	User 7 - IP address
SML10	1	254	-	User 8 - IP address
SML11	1	254	-	User 9 - IP address
SML12	1	254	-	User 10 - IP address
SML13	0	1	-	Consumer 1 - Type
SML14	0	1	-	Consumer 2 - Type
SML15	0	1	-	Consumer 3 - Type
SML16	0	1	-	Consumer 4 - Type
SML17	0	1	-	Consumer 5 - Type
SML18	0	1	-	Consumer 6 - Type
SML19	0	1	-	Consumer 7 - Type
SML20	0	2	-	Consumer 8 - Type
SML21	0	1	-	Consumer 9 - Type
SML22	0	1	-	Consumer 10 - Type
SML26	-50.0	99.9	°C	Producer - Toa - Threshold
SML27	0.0	25.0	°C	Producer - Toa - Cooling differential
SML28	0.0	25.0	°C	Producer - Toa - Heating differential

If communication between the refrigerant unit and the ventilating units is not successful with the parameters set, an alarm appears on the controller of the refrigerant unit.

The alarm only pops up if the ventilating unit is enabled.

Select the icon “SMARTlink+” to access the function screens from the “User” menu.





The value to be entered in the field “IP address” is the last digit in the address (e.g. 10.2.3.xx).

The first three values of the IP address for network identification are the same numbers as in the controller.

The controller IP address set at the factory is 10.2.3.20. If it needs changing, refer to the section “IP addressing” in the controller hardware manual.

The addresses for units in the network can take values between 1 and 254.

All communications with the ventilating units are disabled by default to avoid unnecessary alarms.

3.23.3 Determination of operating mode (only for heat pump units)

The operating mode of heat pump units is connected to the value set in parameter “SP9”, which may be:

- 0 = from user interface;
- 1 = from digital input;
- 2 = from SMART Link+.

When the unit is fitted with the SMART Link+ option, the value of parameter “SP9” is set to “2” at the factory.
Parameter “SP9” must be edited at start-up or when an override is required.

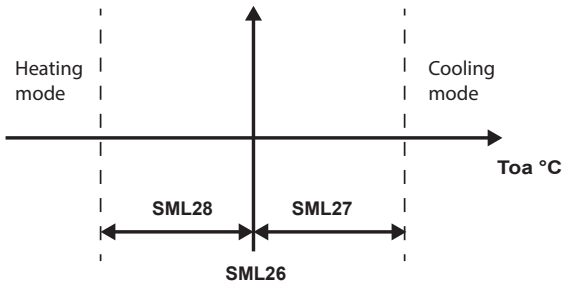
When parameter “SP9” is set to “2”, the controller establishes the operating mode type based on the demand received from the highest number of ventilating units connected.

If the number of demands for cooling is equal to the number of demands for heating, the controller establishes the operating mode to be enabled by comparing the value in parameter “SML26” with the outside air temperature.

If the outside air temperature is higher than the setpoint in parameter “SML26”, the controller sets the unit for operation in cooling mode; if it is lower, it sets the unit for operation in heating mode.

Other parameters are provided in addition to the threshold for operating mode switching (“SML26”). These include the differential for switching to cooling mode (“SML27”) and the differential for switching to heating mode (“SML28”).

A graphical representation is shown below.



When the refrigerant unit is set up for operation in heating mode, it only switches to cooling mode if the air temperature value is higher than threshold “SML26”, plus the relevant differential (“SML27”).

When the refrigerant unit is set up for operation in cooling mode, it only switches to heating mode if the air temperature value is lower than threshold “SML26”, minus the relevant differential (“SML28”).

3.23.4 Setpoint calculation

The refrigerant unit uses an algorithm to calculate the setpoint that best suits the requirements of the ventilating units. When the function is enabled, the parameter that the user uses to edit the unit setpoint is no longer effective for thermoregulation.

The setpoint calculated based on the demands of the ventilating units is in any case included between the min. and max. values of each operating mode (“ST2” and “ST3” for cooling mode; “ST5” and “ST6” for heating mode).

In each case, the setpoint calculated based on the demands of the ventilating units is in any case included between the min. and max. values of each operating mode (“ST2” and “ST3”).

For serial connection and unit operation in the network, also consult the documentation relating to the “GOLD” unit.

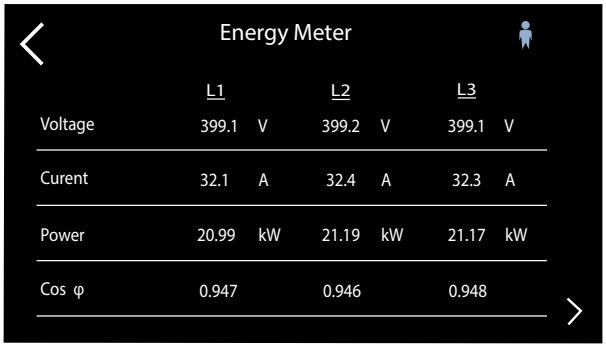
3.24 Energy meter

The option “Energy meter” is designed to control the main electrical parameters of the unit.

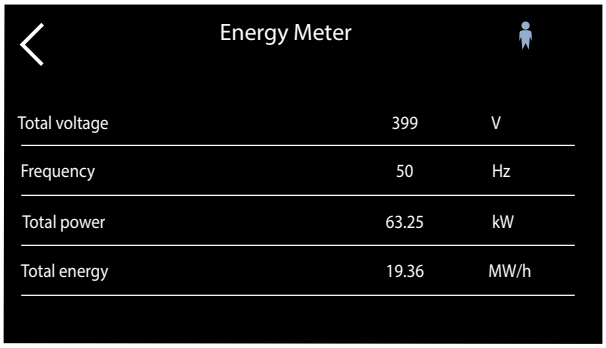
This measuring instrument is installed in the electrical cabinet of the unit and it is configured at the factory. It communicates with the controller serially.

3.24.1 Viewing of measured parameters

The measured parameters are displayed in some of the screens of the “Energy meter” menu in the “USER” menu.



The screen with the total values is evoked using the arrow on the right-hand bottom side of the screen.



The total values are displayed in the screen appearing when the arrow down is tapped.

The energy value is an aggregate value over time. The reset procedure is explained in the meter manual.

Where communication with the measuring instrument fails, the controller warns about this condition causing an alarm window to appear.

All the parameters required to control the function are featured in the password-protected “Parameters” menu inside the corresponding group, which is identified by a prefix.

3.24.2 Limitation of absorbed current using “Energy meter”

The option “Energy meter” may be integrated with an additional option that is designed to limit the electric current absorbed by the unit.

The controller uses as reference the greatest value of absorbed current on the three phases.

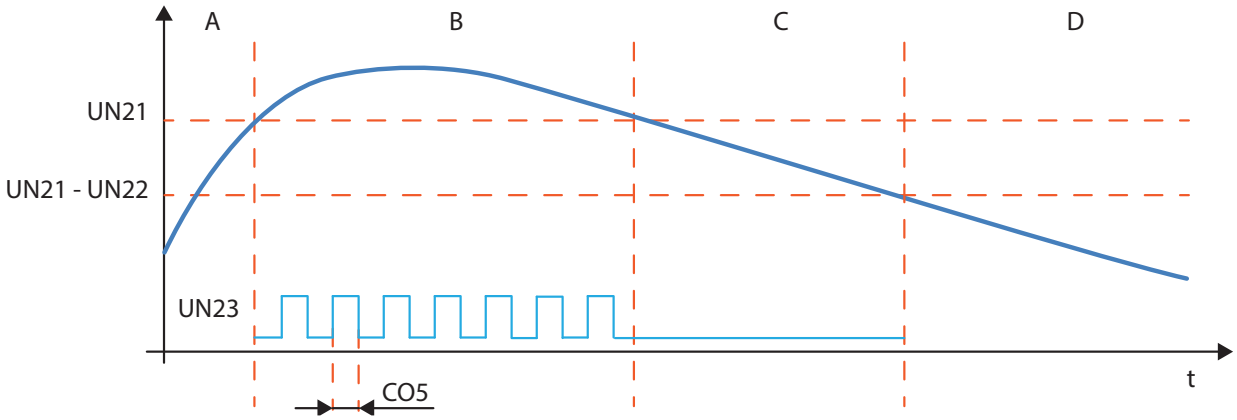
The current is limited by overriding cooling capacity reduction.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN4	2	-	Unloading from Amperometric Transformer
UN17	15	min	Capacity reduction activation time limit
UN18	5	min	Time between two capacity reductions of the same circuit
UN21	250	A	Current capacity reduction threshold
UN22	50	A	Current capacity reduction differential
UN23	2,5	%	Reduction step of current unloading (inverter/hybrid)
CO5	10	s	Min. time between de-activation of 2 compressors/Min. Time between step decrement

A graphical representation is shown below.



The override of unit capacity reduction is enabled when the greatest current value measured on the three phases is higher than the setpoint in parameter “UN21” (phase B). In this phase, the controller enables the “down” pulses according to the delay time set in parameter “ST25” until the absorbed current is lower than the setpoint in parameter “UN21”.

If the value of current is between the value in parameter “UN21” and the difference between the values in parameters “UN21”– “UN22”(phase C), the controller does not change the capacity.

When the current absorbed by the unit is lower than the difference between the values in parameters “UN21” – “UN22” (phase D), the controller exits capacity reduction override mode and the demand for cooling capacity is managed again based on thermoregulation.

The time of the capacity reduction process may be as long as the time setpoint in parameter “UN17”. When this setpoint is exceeded, capacity is managed again based on thermoregulation, irrespective of the absorbed current.

Before a new capacity reduction cycle is started, the time set in parameter “UN18” must elapse.

3.25 2-zone control with “GIT option”

The unit is designed to control two zones in the plant having different temperatures for the sake of comfort. The two zones can be controlled using either one or two 3-way modulating valves.

When only one 3-way valve is used, the directly connected zone is fed with water at the temperature produced by the unit. As water is recycled, the area controlled using the 3-way valve can be fed with water at a different temperature.

If both zones are controlled using 3-way valves, the water supplied to the two zones may be at a different temperature from that of the water produced by the unit.

In winter mode, the temperature of the water recycled by the 3-way valves is lower than the temperature of the water produced by the unit; in summer mode, it is higher.

The temperature value of water used to feed the zone system is controlled by the operating setpoint of the corresponding 3-way valve.

Function control can be adjusted to other system configurations than those described herein.

The controller is programmed in the factory to control 2 zones using two 3-way modulating valves.

The unit commissioner is responsible for setting the value in parameter “ST23” according to the number of valves actually fitted in the system.

If the value set in parameter “ST23” is “2”, meaning 2 zones and one single 3-way valve, the controller controls the valve to set the water temperature in “zone 1”. The temperature probe for “zone 2” must in any case be installed.

This function is not compatible with the function “Thermoregulation from tank-mounted probe (TSS)”.

3.25.1 Parameters involved

The parameters involved in the function setup are shown in the table below.

Parameter	Min	Max	UM	Description
SP23	0	3	-	Secondary circuit enabling
ST40	0	1	-	Setpoint optimisation enabling
ACS55	0	1	-	Action upon ACS demand
PA56	0	9999	s	Secondary circuits - Pump activation delay
PA57	0	9999	s	Secondary circuits - Pump deactivation delay
PID70	0	1	-	V3V Secondary circuits - PID enabling
PID71	6.5	16.0	°C	V3V Secondary circuit 1 - Setpoint in CH
PID72	30.0	80.0	°C	V3V Secondary circuit 1 - Setpoint in HP
PID79	6.5	16.0	°C	V3V Secondary circuit 2 - Setpoint in CH
PID80	30.0	80.0	°C	V3V Secondary circuit 2 - Setpoint in HP
PID87	0	1	-	V3V Secondary circuits - 3-way valve logic
PID88	0	9999	s	V3V Secondary circuits - Delay in valve registration enabling
PID89	0.0	100.0	%	V3V Secondary circuits - Position in standby

3.25.2 System components

The controller is designed to control the following elements in each zone:

- a temperature probe;
- a potential free contact for pump control;
- a digital input for enabling;
- a digital input for connection of an alarm (e.g. pump overload protection or other type);
- an analogue output to set the water temperature using a 3-way valve.

If the zone alarms are not managed, the corresponding terminals in the terminal board must be short-circuited.

3.25.3 Access to screens

Access to the function screens can be gained directly from the icon “2 zones” on the main screen or from the relevant screen of the “User” menu.

The right-hand arrow, as shown in the figure, gives access to the screen where operation of the zone circuit is enabled and the control setpoint of the 3-way valve is set up.

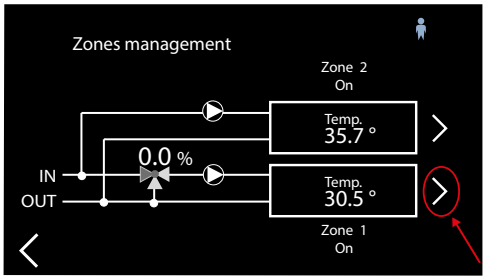


Fig. 44 Screen with “PG23” = 2

All the parameters required to control the function, including the setpoints, are featured in the password-protected “Parameters” menu inside the corresponding group, which is identified by a prefix.

3.25.4 Regulation

Zone control is activated by closing the digital input and enabling the OK signal output by the controller. If “BMS” is enabled, then zone enabling/disabling from the BMS is activated too.

If zone control is not enabled, the 3-way valve is in “Standby” position, as expressed by the percentage value in parameter “PID89”.

When zone control is enabled, the controller starts the water circulation pump after the delay time set in parameter “PA56”.

After the time in parameter “PID88” has elapsed since pump starting, the controller starts adjusting the 3-way valve to control the water temperature.

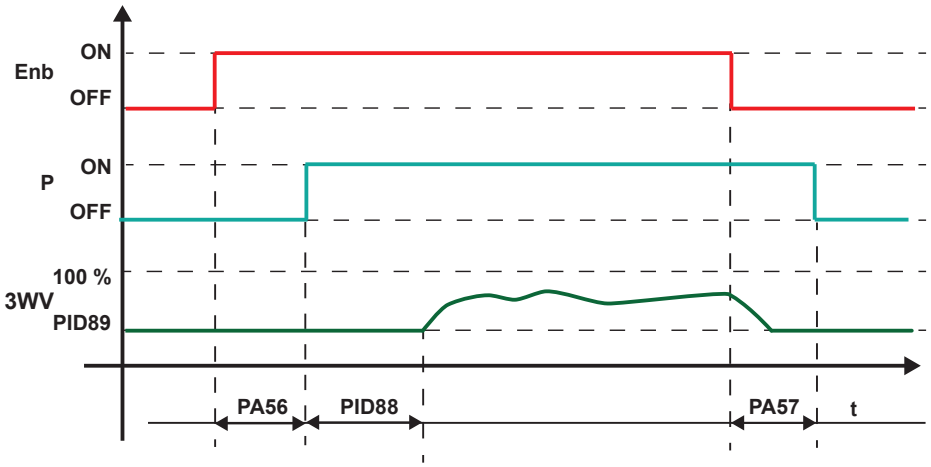
This is a “PID” type control and takes as reference the zone setpoint, as compared with the corresponding water temperature value.

The setpoint for operation in heating mode and the setpoint for operation in cooling mode are provided for each zone.

Zone control is deactivated by way of opening the corresponding digital input or by disabling the control from the keypad or “BMS”.

As soon as zone control is disabled, the 3-way valve goes back to “Standby” position and the controller stops the pump in the zone after the delay time stored in parameter “PA57”.

A graphical representation is shown below.



In addition to the function parameters, the abbreviations in the graph are:

- Enb = to enable operation of the zone system;
- P = to enable the pump in the zone;
- 3WV = 3-way valve status.

3.25.5 Unit setpoint optimisation

The controller features an option designed for the optimisation of the unit setpoint, taking as reference the setpoints in the active zones.

The unit setpoint is optimised using parameter “ST40”.

The unit setpoint is always needed (“ST4” for heating and “ST1” for cooling). When setpoint optimisation is enabled, the unit setpoint value changes according to the enabled zones and the active operating mode.

When operating in heating mode, the unit setpoint is the highest value among those set for the enabled zones. When operating in heating mode, the unit setpoint is the lowest value among those set for the enabled zones.

If no zone is enabled (as a result of function disabling procedures or alarms), the unit setpoint is “ST4” for heating and “ST1” for cooling.

3.25.6 Alarms

To manage the “2 zones” function, the controller controls 2 digital inputs (one per zone) which can be connected in series to the alarms in each zone.

Where necessary, it is possible to connect potential free contacts of the zone pump alarm and any other zone-specific alarm.

If the zone alarms are not managed, the corresponding terminals in the terminal board must be short-circuited.

In addition to the digital input alarms, the controller also monitors correct operation of the temperature probes.

The controller manages the error experienced in the probe and its disconnection.

Zone alarms cause the opening of the physical contact to the pump and the output of the signal to the 3-way valve for it to switch to “Standby” position.

The descriptions of the alarms and the corresponding actions taken by the controller are illustrated in the chapter titled “Alarms”.

3.26 Thermoregulation from tank-mounted probe “TSS”

The function can be enabled/disabled from the keypad or by a digital input. If the “BMS” is installed, the function can also be enabled/disabled by the BMS.

The unit is thermoregulated according to the value sensed by the reference probe and it is activated by the value sensed by the tank-mounted probe.

This function is not compatible with the function “2-zone management (GIT)”.

If the units are connected to a “Multilogic” system, the tank-mounted probe is controlled by the “Master” unit.

3.26.1 Parameters involved

The parameters involved in the function setup are shown in the table below.

Parameter	Min	Max	UM	Description
ST34	0	3	-	Enabling thermoregulation from tank-mounted probe
ST35	6.5	16.0	°C	Setpoint to enable thermoregulation from tank-mounted probe - CH mode
ST36	0.0	50.0	°C	Band to enable thermoregulation from tank-mounted probe - CH mode
ST37	30.0	80.0	°C	Setpoint to enable thermoregulation from tank-mounted probe - HP mode
ST38	0.0	50.0	°C	Band to enable thermoregulation from tank-mounted probe - HP mode
ST39	0	9999	°C	Delay in thermoregulation enabling/disabling from tank-mounted probe

The setpoint value in parameter “ST34” determines the operating modes of the unit for which thermoregulation from the tank-mounted probe is active.

The values required for enabling are as follows: 0 = function disabled; 1 = function enabled for cooling only; 2 = functions enabled for heating only; 3 = function enabled for cooling and heating.

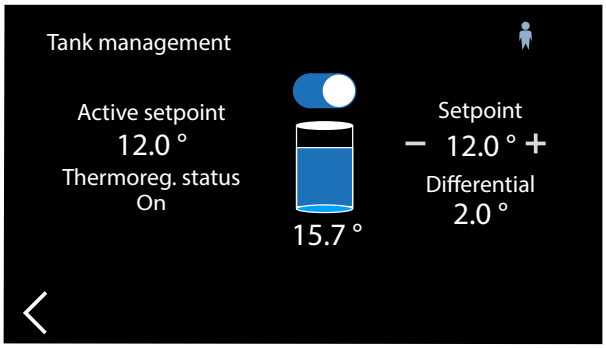
3.26.2 Function screens

When the function is enabled, the icon “**Tank**” appears on the main screen. The icon changes its colour according to the function being enabled and to the unit operating mode.

The tank icon gives access to the screen where the main parameters of the function are featured.

The function screen is used to:

- enable/disable the function;
- read and enter the temperature setpoint required to enable thermoregulation of the unit;
- read the temperature differential required to enable thermoregulation of the unit;
- read the thermoregulation setpoint;
- read the temperature of water in the tank;
- read the thermoregulation status.



All the parameters required to control the function are featured in the password-protected “Parameters” menu inside the corresponding group “ST”.

3.26.3 Regulation

The compressors get started as soon as the demand is received from the probe that measures the water temperature in the tank.

The demand must be active for longer than the value stored in parameter “ST39”.

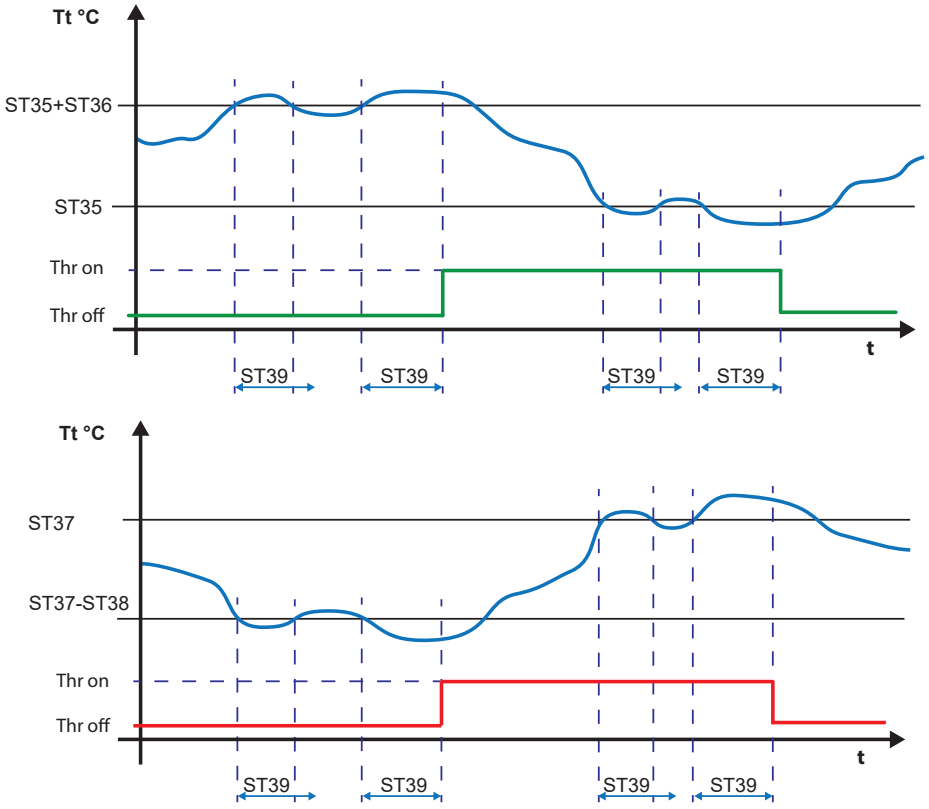
The cooling demand is active when the temperature measured in the tank is higher than the cooling setpoint plus the relevant differential. The heating demand is active when the temperature measured in the tank is lower than the heating setpoint minus the relevant differential.

When the demand is active, the compressors switch on and off following the unit setpoint and the water temperature measured by the reference probe.

As soon as the demand from the tank-mounted probe is met for longer than the time setpoint in parameter “ST39”, the unit starts the stop procedure according to the preset times.

The cooling demand is met when the temperature measured in the tank is lower than the cooling setpoint. The heating demand is met when the temperature measured in the tank is higher than the heating setpoint.

Below are the graphical representations of unit operation in cooling and heating mode.



In addition to the function parameters, the abbreviations in the graph are as follows:

- Tt = water temperature in the tank;
- Thr on = thermoregulation demand ON;
- Thr off = thermoregulation demand OFF;
- t = time.

3.26.4 Alarms

If the tank-mounted probe malfunctions or is not connected, the controller disables the function, keeps the pump active and controls the compressors using the reference probe and the stored setpoint.

The description of the alarm and the corresponding actions taken by the controller are illustrated in the chapter titled “Alarms”.

3.27 Electronic expansion valve

The use of the electronic expansion valve allows very precise, stable and reliable control of refrigerant flow with consequent increase in efficiency.

The controller manages the electronic expansion valve and controls its opening based on the performance required by the system in all working conditions, to ensure low superheating over time that optimizes the performance of the unit and increases the benefits of floating condensation.

Also, the controller can act on the control of the electronic expansion valve to prevent the occurrence of operating conditions that can damage the compressor.

The parameters involved are shown in the table.

Parameter	Min	Max	UM	Description
Et24	45	2400	steps	Chiller - Pre-positioning of valve before the compressors start
Et25	0	999	s	Delay on starting before enabling the PID control
Et27	0	999	s	LOP function activation delay (low evaporating pressure)
Et28	0	999	s	MOP function activation delay (high evaporating pressure)
Et29	0	999	10 s	High superheating function activation delay
Et30	0	999	10 s	Low superheating function activation delay
Et31	0.0	25.5	°C	Chiller - PID, proportional coefficient
Et32	0	999	s	Chiller - PID, integral time
Et33	0	999	-	Chiller - PID, derivative time
Et34	0.0	110.0	°C	Chiller - Superheating setpoint
Et35	0.0	25.5	°C	Chiller - Neutral control zone
Et36	5.0	110.0	°C	Chiller - High superheating protection threshold
Et37	0.0	5.0	°C	Chiller - Low superheating protection threshold
Et39	-50.0	110.0	°C	Chiller - MOP protection threshold
Et41	-50.0	110.0	°C	Chiller - LOP protection threshold
Et48	0.0	25.5	°C	Heat pump - PID, proportional coefficient
Et49	0	999	s	Heat pump - PID, integral coefficient
Et50	0	999	-	Heat pump - PID, derivative coefficient
Et51	0.0	110.0	°C	Heat pump - Superheating setpoint
Et53	5.0	110.0	°C	Heat pump - High superheating protection threshold
Et54	0.0	5.0	°C	Heat pump - Low superheating protection threshold
Et56	-50.0	110.0	°C	Heat pump - MOP protection threshold
Et58	-50.0	110.0	°C	Heat pump - LOP protection threshold
Et61	1	999	s	Heat pump - Filter on the evaporating pressure
Et62	1	999	s	Heat pump - Valve position update filter
Et65	0.1	25.5	°C	Defrost - PID, proportional coefficient
Et66	0	999	s	Defrost - PID, integral coefficient
Et67	0.1	25.5	°C	Defrost - Superheating setpoint
Et68	-50.0	110.0	°C	Defrost - MOP protection threshold
Et69	-50.0	110.0	°C	Defrost - LOP protection threshold
Et70	0	999	s	Defrost - PID control delay after start of defrost
Et71	0	999	-	Defrost - Minimum valve opening percentage during defrost
Et73	0	999	-	Valve pre-positioning during capacity change of compressors
Et76	0	999	s	Low superheating alarm delay

3.27.1 Superheating management

The main parameter controlled by the electronic expansion valve is the superheating value of the gas at the outlet of the evaporator.

The PID control algorithm allows the superheating value, at the various operating conditions, to be kept close to the value of the set setpoint.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et31	10.0	°C	Chiller - PID, proportional coefficient
Et32	100	s	Chiller - PID, integral time
Et33	1	-	Chiller - PID, derivative time
Et34	5.0	°C	Chiller - Superheating setpoint
Et48	10.0	°C	Heat pump - PID, proportional coefficient
Et49	100	s	Heat pump - PID, integral coefficient
Et50	1	-	Heat pump - PID, derivative coefficient
Et51	5.0	°C	Heat pump - Superheating setpoint
Et65	10.0	°C	Defrost - PID, proportional coefficient
Et66	100	s	Defrost - PID, integral coefficient
Et67	5.0	°C	Defrost - Superheating setpoint

The values set in the controller are the result of tests and the manufacturer's experience.
Any change to these values must be approved by the manufacturer.

It might take a few minutes to reach the optimal set point.

3.27.2 Control in high superheating conditions

Prolonged continuation of the condition in which the superheating value exceeds the threshold set by the manufacturer will cause damage to the compressors.

When this condition occurs, the controller changes the opening of the expansion valve.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et29	2	10 s	High superheating function activation delay
Et36	15.0	°C	Chiller - High superheating protection threshold
Et53	15.0	°C	Heat pump - High superheating protection threshold

The values set in the controller are the result of tests and the manufacturer's experience.
Any change to these values must be approved by the manufacturer.

The high superheating condition ends when the superheating value falls by 1°C below the protection threshold.

3.27.3 Control in low superheating conditions

Prolonged continuation of the condition in which the superheating value is lower than the threshold set by the manufacturer will cause damage to the compressors.

When this condition occurs, the controller changes the opening of the expansion valve.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et30	30	10 s	Low superheating function activation delay
Et37	2.0	°C	Chiller - Low superheating protection threshold
Et54	2.0	°C	Heat pump - Low superheating protection threshold
Et76	60	s	Low superheating alarm delay

The values set in the controller are the result of tests and the manufacturer's experience.

Any change to these values must be approved by the manufacturer.

The low superheating condition ends when the superheating value exceeds the protection threshold by 1°C.

The low superheating condition ends when the superheating value exceeds the protection threshold by 1.8°F.

In the event of an alarm, the reset is automatic for the number of occurrences in one hour set in parameter PAL4.

In the event of automatic reset, the minimum stop time is always complied with.

In the event of a low superheating alarm, make sure the valve is working correctly using the manual controls.

If the alarm persists, contact the manufacturer.

Control of the MOP ends if the low superheating condition occurs.

3.27.4 Control in MOP conditions

Prolonged continuation of the condition in which the suction pressure value exceeds the MOP (Maximum Operating Pressure) threshold set by the manufacturer will cause damage to the compressors.

When this condition occurs, the controller stops the PID superheating control and, with suitable algorithm, closes the expansion valve.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et28	10	s	MOP function activation delay (high evaporating pressure)
Et39	15.0	°C	Chiller - MOP protection threshold
Et56	15.0	°C	Heat pump - MOP protection threshold
Et68	50.0	°C	Defrost - MOP protection threshold

The values set in the controller are the result of tests and the manufacturer's experience.

Any change to these values must be approved by the manufacturer.

The MOP condition ends when the suction pressure value falls by 1°C below the protection threshold value.

3.27.5 Control in LOP conditions

The LOP (Low Operating Pressure) threshold set by the manufacturer is the suction pressure value below which the low pressure alarm intervenes with stopping of the refrigerant circuit.

When this condition occurs, the controller stops the PID superheating control and, with suitable algorithm, opens the expansion valve.

The relevant parameters are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et27	1	s	LOP function activation delay (low evaporating pressure)
Et41	-30.0	°C	Chiller - LOP protection threshold
Et58	-30.0	°C	Heat pump - LOP protection threshold
Et69	-25.0	°C	Defrost - LOP protection threshold

The values set in the controller are the result of tests and the manufacturer's experience.

Any change to these values must be approved by the manufacturer.

The LOP condition ends when the suction pressure value exceeds the protection threshold by 0,1°C.

The LOP condition ends when the suction pressure value exceeds the protection threshold by 0,18°F.

4 ALARMS

4.1 Introduction

The active alarms generated by the application software can activate a relay, if suitably configured.

The relay is switched on if:

- there is an active alarm;
- there is an alarm that has not been reset;

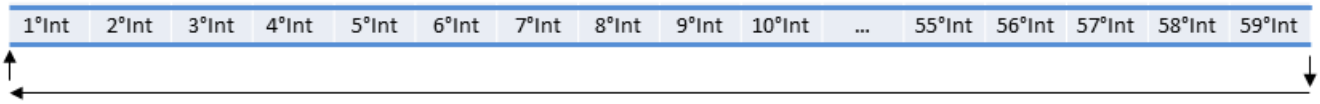
The display is not supplied with a buzzer.

The relay will be switched off if:

- there are no active alarms.

4.1.1 Automatic/Manual procedure and alarm reset

The holding of the alarms takes place considering a time window of 1 hour. The hour is divided into 60 intervals of 1 minute each.

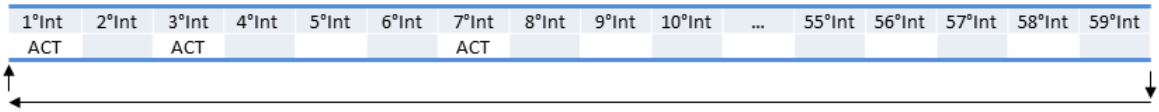


The window is sliding as regards the alarm event and always covers the last hour. During the interval of one minute, if an occurrence is detected, this time interval is considered active.

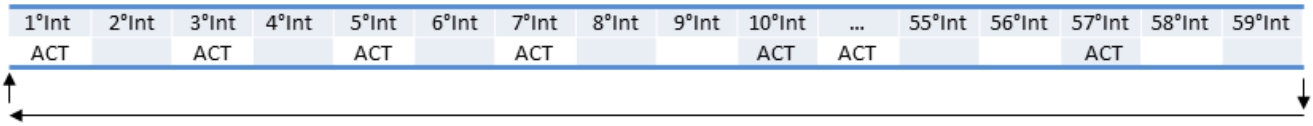
"ACT" is assigned to the active interval to record the event. The sum of the active intervals in the last hour allows the number of events/alarms per hour to be calculated.

If the sum of the active intervals does not exceed the respective threshold value of occurrences/hour, they are deleted.

Two examples are given below with threshold of occurrences/hour = 5



In the first example, since the number of active intervals is 3, which is lower than the threshold of occurrences/hour set to 5, the events are deleted.



In the second example, the number of active intervals is 7, and therefore exceeds the threshold of occurrences/hour set to 5. In this case, the alarm becomes a manual reset alarm and therefore the work of technical personnel will be necessary.

Even if the alarm is no longer active, only a manual reset will cause the deletion of the alarm from the display and from the list of active alarms.

Alarms that merely notify, that is, no output is energized/de-energized are also managed in the application. These are called WARNINGS.

4.2 Unit alarms

The unit alarms immediately cause all the compressors and relevant additional functions to be switched off.

4.2.1 Flow switch alarm

Management of the flow switch alarm depends on whether or not pumps are present in the unit.

If it is the controller that manages the pumps of the unit, the parameters involved are shown in the table below.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PA1	1 or 2	-	User-side pump management
PAL103	15	s	User-side flow switch; alarm delay when the pump is started
PAL105	5	s	User-side flow switch; alarm delay at steady state

Alarm code	**AL3**
Reason for activation	When the relevant digital input is open for a time longer than PAL103 when the unit is started or
	for a time longer than PAL105 after PAL103 has elapsed
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Anti-freeze heaters	Follows the control
The other devices	Switched off

A graphical example is shown below of flow switch alarm management with parameter PA1 = 1 or 2.

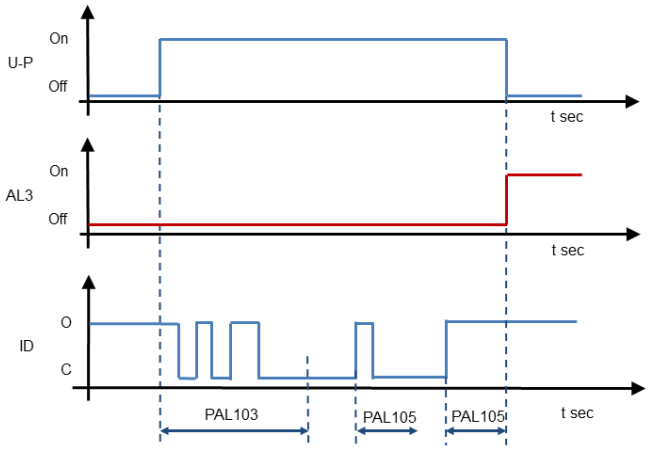


Fig. 45 Activation of flow switch alarm AL3 / AL303

In addition to the parameters present in the table, the other abbreviations in the graph indicate:

- U/P = relating to the "unit" or "pump" device
- On = state of the device
- Off = state of the device
- ID = digital input to which the flow switch is connected
- O = open
- C = closed
- t = time.

If it is not the controller that manages the pumps of the unit, the parameters involved are shown in the table below.

Parameter	Value	UM	Description
PA1	0	-	User-side pump management
PAL58	5	s	Alarm activation delay
PAL59	2	10 s	Alarm over delay

Alarm code	AL2
Reason for activation	When the relevant digital input is open for a time longer than PAL58
Reset mode	Manual after closing of the digital input and after time PAL59
	With the reset of the alarm, the unit restarts
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Anti-freeze heaters	Follows the control
The other devices	Switched off

A graphical example is shown below of flow switch alarm management with parameter PA1 = 0.

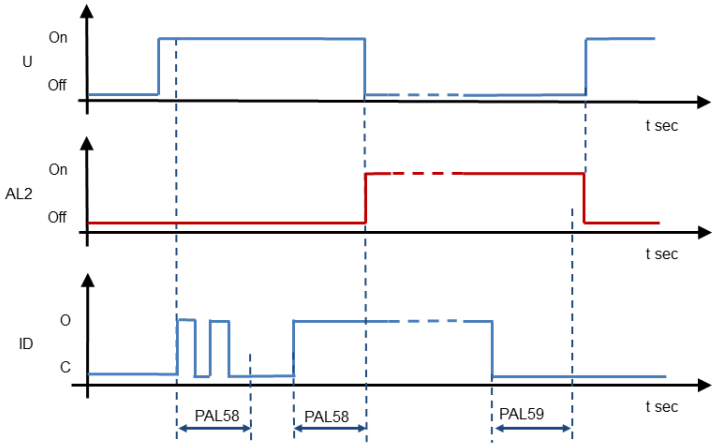


Fig. 46 Activation of flow switch alarm AL2 / AL302

In addition to the parameters present in the table, the other abbreviations in the graph indicate:

- U = relating to the status of the unit
- On = state of the device
- Off = state of the device
- ID = digital input to which the flow switch is connected
- O = open
- C = closed
- t = time.

4.2.2 Antifreeze alarm

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL36	3.0	°C	User-side water antifreeze - alarm threshold
PAL37	4.0	°C	User-side water antifreeze - alarm differential
PAL47	6	-	User-side water antifreeze - Selection of probe on which to check the antifreeze

The alarms are activated when the temperature value of the antifreeze probe is lower than parameter PAL36.

Output water probe antifreeze alarm

With the value of parameter PAL47 set to 6, the antifreeze alarm is managed with the probe installed on the water leaving the evaporator.

Alarm code	AL78
Reason for activation	Antifreeze threshold reached by the probe placed at the outlet of the heat exchanger
Reset	When the temperature measured by the antifreeze probe is higher than the value set in parameter PAL36 plus PA37
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Anti-freeze heaters	They follow the control
Unit pump	Follows the control or switched off
The other devices	They follow the control
Compressor	Off

Inlet water probe antifreeze alarm

Alarm code	AL77
Reason for activation	The temperature measured by inlet water probe is lower than the value set in parameter PAL36
Reset	When the temperature measured by inlet water probe is higher than the value set in parameter PAL36 plus PAL3
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Devices	**Behaviour in the event of an alarm**
Anti-freeze heaters	They follow the control
Unit pump	Follows the control or switched off
The other devices	They follow the control
Compressor	Off

4.2.3 Generic alarm

This alarm is only enabled if the controller is provided with a digital input for serious external alarms.

Alarm code	AL98
Reason for activation	Upon opening of relevant digital input
Reset	Manual, after closing of the digital input that has generated it
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Immediate operation stop

4.2.4 Low incoming water temperature alarm

The alarm is active only in heat pump operating mode.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL84	3	-	Maximum number of alarms in one hour
PAL85	90	10 s	Low user-side inlet temperature alarm delay in heat pump mode
PAL86	25.0	°C	Low user-side inlet temperature alarm threshold in heat pump mode
PAL87	5.0	°C	Low user-side inlet temperature alarm differential in heat pump mode

Alarm code	**AL7**
Reason for activation	With unit running, if the user-side exchanger inlet water temperature is lower than parameter PAL86 for the time of parameter PAL85
Reset	When the user-side exchanger inlet water temperature is higher than parameter PAL86 plus parameter PAL87
Reset mode	Automatic for a number of interventions in one hour equal to the value of parameter PAL84, and then manual
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Switched off
The other devices	They follow their control

4.2.5 High incoming water temperature alarm

The alarm is active only in chiller operating mode.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL60	4	-	Maximum number of user-side high temperature alarms in one hour in chiller mode
PAL61	30	10 s	User-side high temperature delay in chiller mode
PAL62	30.0	°C	User-side high temperature alarm threshold in chiller mode
PAL63	5.0	°C	User-side high temperature alarm differential in chiller mode

Alarm code	**AL55**
Reason for activation	With unit running, if the user-side exchanger inlet water temperature > = PAL62 for PAL61 seconds
Reset	When the user-side exchanger inlet water temperature < = PAL62 - PAL63.
Reset mode	Automatic, and becomes manual after the number of occurrences/ hour of PAL60
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	No
Devices	**Behaviour in the event of an alarm**
All devices	They follow their control

4.2.6 Low ambient temperature alarm

The alarm is detected only in heat pump operating mode.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL116	1	-	Enables the low outside air temperature alarm in heat pump mode
PAL117	60	-	Maximum number of low outside air temperature alarms in one hour
PAL118	-15.0	°C	Low outside air temperature alarm threshold
PAL119	2.0	°C	Low outside air temperature alarm differential

Alarm code	**AL14**
Reason for activation	If the outside air temperature <= parameter PAL118
Reset	When the outside air temperature >= PAL118 + PAL119
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
System pump	Follows the control
The other devices	Switched off

4.2.7 Wrong phase sequence alarm

The alarm is detected only for the time set in parameter CO7 when the controller is started.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
CO7	25	s	Load activation delay at switch-on

Alarm code	AL22
Reason for activation	With digital input open for time CO7 seconds when the controller is switched on.
Reset	After correctly connecting the phase sequence, when the controller is next started with the digital input closed
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
All devices	Switched off

4.2.8 Maximum/minimum voltage alarm

Alarm code	AL72
Reason for activation	With digital input open
Reset	When the digital input closes
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
All devices	Switched off

4.2.9 Alarm: expansion module not connected

If communication between the controller and the expansion module fails, the outputs of the expansion module are deactivated after 5 seconds.

Alarm code	**AL148**
Reason for activation	Communication failure between the controller and expansion module cPcoe
Reset	If the module is disabled or resumes communication
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
cPcoe	Outputs deactivated after 5 seconds
The other devices	Depends on the configuration

4.2.10 Alarm: Flowzer offline

Alarm code	**AL99**
Reason for activation	Serial communication failure
	The alarm activates after the delay set on parameter "CO43"
Reset	Restoration of communication
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Pump	Stopping of the user-side pump
Unit	Stop due to flow switch alarm

4.2.11 “RTC” clock alarm

Alarm code	**AL74**
Reason for activation	Low level of controller battery charge
Reset	When the controller time or date is reset.
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
All devices	They follow their control

Replace the controller if the alarm is not cleared after setting the time.

4.2.12 Internal memory alarm

Alarm code	**AL1**
Reason for activation	Incorrect programming of the controller
Reset	Correct programming
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
All devices	Stopping of operation

Contact the manufacturer.

4.3 Function alarms

Alarms linked to the functions managed by the controller are described below.

4.3.1 Unit operation warning messages

The alarms regarding the pump are shown below.

Maintenance

Alarm code	**AL50**
Reason for activation	This is detected when the work hours exceed the set limit
Reset	Upon deletion of the hours in the Service or Maintenance menu
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Pump in alarm	Follows its control
The other devices	They follow their control

Pump thermal overload switch

Alarm code	**AL16**
Reset	With digital input closed
Reset mode	Always manual
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Pump	Operation of the pump in alarm is prevented
The other devices	They follow their control

4.3.2 Ventilation alarm

Alarm code	**AL15**
Reason for activation	with digital input open
Reset	According to factory settings
Reset mode	Manual or automatic, according to the factory setting
Alarm icon	Flashing
AlarmLog	YES
Devices	**Behaviour in the event of an alarm**
Fan in alarm	Follows its control (stopping takes place electro-mechanically)
The other devices	They follow their control

4.3.3 Refrigerant leak alarm

The refrigerant leak alarm is shown below.

If the refrigerant leak causes hazardous conditions, the electro-mechanical management procedure is illustrated in the “Instruction Manual for Installation, Use and Maintenance”.

Alarm code	**AL61**
Reason for activation	When the digital input for the refrigerant detector in the controller is open
Reset	Automatic, and becomes manual after repeated occurrences
Reset mode	Only the service personnel may reset the manual alarm.
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Circuit in alarm	Depending on the setting, it is stopped or follows the control
The other circuits and devices	They follow their control

4.3.4 Alarms concerning refrigerant leak detector sensor maintenance

The alarms warning about maintenance of the refrigerant leak detector are shown below.

Alarm code	**AL119 Refrigerant sensor inspection/calibration about to expire**
Reason for activation	When the inspection/calibration expiry date is approaching.
Reset	Manual
Reset mode	Only the service personnel may reset the manual alarm.
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
The unit	Normal operation continues.

Alarm code	**AL123 Refrigerant sensor calibration expired**
Reason for activation	After the inspection/calibration time has expired.
Reset	Manual
Reset mode	Only the service personnel may reset the manual alarm.
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
The unit	Normal operation continues.

Alarm code	**AL131 Unit OFF - The refrigerant sensor inspection/calibration time has expired.**
Reason for activation	After the inspection/calibration time (“PAL130” = “1”) has expired (“PAL128” + “PAL129”).
Reset	Manual
Reset mode	Only the service personnel may reset the manual alarm.
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
The unit	Unit blocked

4.3.5 Defrost time out failure

Alarm code	**AL68 Defrost alarm**
Reason for activation	If a defrost ends due to time limit instead of due to condensing temperature threshold
Reset	Automatic
Reset mode	At the next defrost ended with exceeding of the condensation threshold
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
The other circuits and devices	They follow their control

4.3.6 “ACS” alarms

Below is a list of the alarms regarding the “ACS” function.

Thermal cut-outs in heaters supplementing heating power in “ACS” system

Alarm code	**AL102, AL103, AL104, and AL105**
Reason for activation	Upon opening of the digital input configured for the corresponding alarm
Reset	Only after closing of the digital input
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Output in alarm	Output regulated if "ACS39" = 0; no regulation if "ACS39" = 1
The other circuits and devices	They follow their control

Exit from “ACS” due to max. time

Alarm code	**AL106**
Reason for activation	It is detected when the “ACS” function does not achieve the corresponding setpoint within the time stored in “ACS28”.
Reset	If the demand persists, after the time set in “ACS10” has elapsed
Reset mode	Automatic
Alarm icon	No
AlarmLog	No
Devices	**Behaviour in the event of an alarm**
“ACS” function	Stopped
System demands	They follow their control

Exiting anti legionella cycle due to max. time

Alarm code	**AL107**
Reason for activation	If the anti legionella cycle does not finish within the time set in parameter "ACS22"
Reset	Automatic
Reset mode	Automatic
Alarm icon	No
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Unit functions	After regulations

Failure to perform defrost cycle

Alarm code	**AL108**
Reason for activation	System circuit function disabled upon demand for defrost cycle
Reset	As soon as the system circuit is restarted
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
“ACS” function	Deactivated

Forced exit from “ACS” function

Alarm code	**AL109**
Reason for activation	As soon as “ACS7” value relating to output water temperature from unit is achieved
Reset	Drop of the output water temperature in the unit by the value set in “ACS8” as opposed to the “ACS7” setpoint
Reset mode	Automatic until the number of times set in “ACS29” is achieved, and then manual
Alarm icon	No
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
“ACS” function	Deactivated
Air conditioning function	After temperature regulation

Failure to perform anti legionella cycle

Alarm code	**AL110**
Reason for activation	The production of hot sanitary water has not achieved the setpoint within the time set in parameter “ACS7”.
Reset	Automatic
Reset mode	Automatic
Alarm icon	No
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Air conditioning function	After temperature regulation

“ACS” reference probe

Alarm code	**AL38**
Reason for activation	The “ACS” reference probe is malfunctioning or it is not connected
Reset	As soon as correct probe operation is resumed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
“ACS” function	Deactivated
Air conditioning function	After temperature regulation

4.3.7 Alarms relating to 2-zone function (GIT option)

Below is a list of the alarms linked to the function that is used to control up to 2 zones of the system (GIT option).

Probe error in secondary circuit

Alarm code	**AL151 Error: probe in secondary circuit 1 AL152 Error: probe in secondary circuit 2**
Reason for activation	The probe in the zone is malfunctioning or it is not connected.
Reset	As soon as correct probe operation is resumed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Alarmed zone	The pump stops and the 3-way valve is overridden to standby position.
The other circuits and devices	They follow their control

Secondary circuit alarm

Alarm code	**AL45 Secondary circuit 1 alarmed; AL117 Secondary circuit 2 alarmed**
Reason for activation	With opening of the relevant digital input
Reset	With digital input closed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Alarmed zone	The pump stops and the 3-way valve is overridden to standby position.
The other circuits and devices	They follow their control

4.3.8 Tank thermoregulation alarms (TSS option)

The function “Thermoregulation from tank-mounted probe (TSS option)” is connected with a probe alarm.

Tank probe error

Alarm code	**AL44**
Reason for activation	The probe in the zone is malfunctioning or it is not connected.
Reset	As soon as correct probe operation is resumed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Function management	The function is disabled: the controller carries on thermoregulation with the reference probe and according to the stored setpoint.

4.3.9 Auxiliary heating alarm

With reference to auxiliary heating management, a digital input is installed to manage the display of a serious alarm, if any.

Refer to the wiring diagram for the relevant digital input.

Alarm code	**AL127**
Reason for activation	Opening of relevant digital input
Reset	Automatic upon closing of relevant digital input
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Function management	The function is disabled. If the unit is in heat pump mode, heating continues with the compressors.

4.4 Circuit alarms

The circuit alarms occur only on the compressors of the circuit involved.

4.4.1 High-pressure alarms

The delivery pressure is controlled by a safety pressure switch and a pressure sensor.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL11	39.5	bar	High pressure alarm threshold
PAL12	5.0	bar	High pressure alarm differential
PAL13	2	-	Maximum number of alarms in one hour due to high pressure
FA2	0	-	Ventilation operating mode

Pressure switch high pressure alarm

Alarm code	**AL5**
Reason for activation	With unit running, when the digital input opens where the relevant pressure switch is connected
Reset	When the relevant digital input closes
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
Ventilation	In chiller operating mode, if FA2=0, with activation of the alarm, ventilation is forced for 60 seconds at maximum speed before stopping
The other devices	They follow their control

STO inverter active-High pressure switch

Alarm code	**AL150**
Reason for activation	Serially, by the inverter when the pressure switch is connected to the safety input of the compressor inverter
Reset	When the relevant digital input closes
Reset mode	Manual
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
Ventilation	In chiller operating mode, if FA2=0, with activation of the alarm, ventilation is forced for 60 seconds at maximum speed before stopping
The other devices	They follow their control

Probe high pressure alarm

Alarm code	**AL6**
Reason for activation	With unit running, if the value measured by the pressure probe is >=PAL11
Reset	When the value measured by the pressure probe is <= (PAL11 - PAL12)
Reset mode	Automatic, and becomes manual after PAL13 occurrences/hour
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
Ventilation	If FA2=0, with activation of the alarm, ventilation is forced for 60 seconds at maximum speed before stopping
The other devices	They follow their control

4.4.2 High discharge gas temperature alarm

The parameter involved is shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL50	135.0	°C	Delivery gas high temperature alarm threshold
PAL51	30.0	°C	Delivery high temperature alarm differential
PAL52	2	-	Maximum number of alarms in one hour due to high delivery temperature
FA2	0	-	Ventilation operating mode

Alarm code	AL23
Reason for activation	If the value measured by the temperature probe is >= PAL50
Reset	When the value measured by the temperature probe is <= (PAL50 - PAL51)
Reset mode	Automatic, and becomes manual after PAL52 occurrences/hour
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
Ventilation	If FA2=0, with activation of the alarm, ventilation is forced for 60 seconds at maximum speed before stopping
The other devices	They follow their control

4.4.3 Alarm for low difference between high and low pressure

Checking of the difference between high and low pressure values takes place when at least one compressor of the circuit involved is running.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL89	5.0	bar	Low pressure difference alarm threshold
PAL90	90	s	Low pressure difference alarm delay on starting of compressors
PAL91	10	s	Low pressure difference alarm delay at steady state
PAL92	2	-	Maximum number of alarms in one hour due to low pressure difference

Alarm code	AL43
Reason for activation	When a compressor of the circuit starts, if the pressure difference is <= PAL89 for PAL90 seconds
	After PAL90 has elapsed, if the pressure difference is <= PAL89 for PAL91 seconds
Reset mode	Automatic, and becomes manual after PAL52 occurrences/hour
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
The other devices	They follow their control

4.4.4 Probe low pressure alarm

The suction pressure is controlled by a pressure sensor.

The controlled limits are different with the different operating modes.

If the value of parameter PAL5 is set to "1", pressure control is also done during defrost.

If the value of parameter PAL7 is set to "1", pressure control is also done with the unit switched off.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL1	15	s	Low pressure alarm delay on starting of the circuit
PAL2	0.2	bar	Low pressure alarm threshold in chiller operating mode
PAL3	1.0	bar	Low pressure alarm differential in chiller operating mode
PAL4	2	-	Maximum number of alarms in one hour due to low pressure
PAL5	1	-	Enables the low pressure alarm during defrost
PAL6	10	s	Low pressure alarm delay during defrost
PAL7	0	-	Enables the low pressure alarm with unit switched off
PAL8	0.1	bar	Low pressure alarm threshold in heat pump operating mode / defrost mode
PAL9	1.0	bar	Low pressure alarm differential in heat pump operating mode / defrost mode
PAL10	5	s	Low pressure alarm delay at steady state (excluding defrost)
PAL10	5	s	Low pressure alarm delay at full operating speed

Alarm code	**AL73**
Reason for activation	If the value measured by the pressure probe is <= PAL2 in chiller operating mode
	If the value measured by the pressure probe is <= PAL8 in heat pump operating mode and defrost mode
	The alarm is detected PAL1 seconds after the first compressor of the circuit starts.
	When delay PAL1 has elapsed, the alarm is detected after PAL10 during operation.
	During defrost, after the first reversal of the refrigeration cycle, the alarm is detected after PAL6 seconds
Reset	In chiller operating mode, when the value measured by the pressure probe is >= (PAL2 +PAL3)
	In heat pump operating mode, when the value measured by the pressure probe is >= (PAL8 +PAL9)
Reset mode	Automatic, and becomes manual after PAL4 occurrences/hour
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
The other devices	They follow their control

4.4.5 Forcing of capacity reduction from low pressure probe

This function is always present in units with the value of parameter UN3 on "1".

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN9	5.0	bar	Low pressure capacity reduction threshold in chiller operating mode
UN10	1.0	bar	Low pressure capacity reduction differential in chiller operating mode
UN11	2.5	bar	Low pressure capacity reduction threshold in heat pump operating mode
UN12	1.0	bar	Low pressure capacity reduction differential in heat pump operating mode
UN13	50	%	Capacity reduction percentage for individual circuit
UN17	2	min	Capacity reduction activation time limit
UN18	2	min	Time between two capacity reductions of the same circuit

Alarm code	AL70
Reason for activation	If the value measured by the pressure probe is < UN9 in chiller operating mode or UN12 in heat pump mode
	If the value measured by the pressure probe is < UN9
Reset	When the value measured by the pressure probe is > (UN9 + UN10) in chiller operating mode
	When the value measured by the pressure probe is > (UN12 +UN13) in heat pump operating mode
	In any case, when the time of parameter UN17 has elapsed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	No
Devices	**Behaviour in the event of an alarm**
All devices	Follow their control

4.4.6 Forcing of capacity reduction from high pressure probe

This function is always present in units with the value of parameter UN3 on "1".

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
UN5	39.0	bar	High pressure capacity reduction threshold in chiller operating mode
UN6	3.0	bar	High pressure capacity reduction differential in chiller operating mode
UN7	39.0	bar	High pressure capacity reduction threshold in heat pump operating mode
UN8	5.0	bar	High pressure capacity reduction differential in heat pump operating mode
UN13	50	%	Capacity reduction percentage for individual circuit
UN17	2	min	Capacity reduction activation time limit
UN18	2	min	Time between two capacity reductions of the same circuit

Alarm code	AL71
Reason for activation	If the value measured by the pressure probe is > UN5 in chiller operating mode or UN7 in heat pump mode
	If the value measured by the pressure probe is > UN5
Reset	When the value measured by the pressure probe is < (UN5 - UN6) in chiller operating mode
	When the value measured by the pressure probe is > (UN7 +UN8) in heat pump operating mode
	In any case, when the time of parameter UN17 has elapsed
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	No
Devices	**Behaviour in the event of an alarm**
All devices	Follow their control

4.4.7 Low superheating alarm

The alarm causes the compressor to stop.

The parameters involved are shown in the table.

The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
Et30	30	10 s	Low superheating function activation delay
Et37	2.0	°C	Chiller - Low superheating protection threshold
Et54	2.0	°C	Heat pump - Low superheating protection threshold
Et76	60	s	Low superheating alarm delay

Alarm code	AL63
Reason for activation	If the measured superheating value is lower than threshold ET37 for a time longer than the sum of the values set in parameters ET30 and ET76
Automatic reset	Until the number of occurrences in one hour set in parameter PAL4 is reached
Manual reset	When the number of occurrences in one hour set in parameter PAL4 is exceeded
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	YES
Devices	**Behaviour in the event of an alarm**
Compressors	Only those of the circuit involved are switched off
The other devices	They follow their control

In the event of a low superheating alarm, make sure the valve is working correctly using the manual controls.

If the alarm persists, contact the manufacturer.

4.5 Compressor alarms

The alarms of a compressor are:

- compressor overload protection
- compressor oil level
- inverter offline
- compressor operation outside envelope
- inverter alarm.
- compressor maintenance;

4.5.1 Compressor Overload Protection Alarm

Alarm code	**AL11**
Reason for activation	The alarm is detected after the compressor is switched on
	It is detected when the relevant digital input is open
Reset	When the digital input closes
Reset mode	Always manual; after repeated occurrences, only the service personnel can reset the alarm
Alarm icon	Flashing
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Compressor in alarm	Always switched off
Other devices	They follow their control

The digital input activating the “compressor thermal overload protection” alarm can be used to connect the alarm contact of various devices.

To trace back the cause of the alarm, refer to the wiring diagram of the unit where the contacts of the connected devices are shown.

4.5.2 Compressor maintenance alarm

Alarm code	**AL47**
Reason for activation	This is detected when the work hours of the compressor exceed the set limit
Reset	Upon deletion of the hours in the Service or Maintenance menu
Alarm icon	Flashing
AlarmLog	YES
Devices	**Behaviour in the event of an alarm**
Compressor in alarm	Follows its control
All	They follow their control

4.5.3 Inverter Fault

Alarm code	**AL149**
	The alarm code is present in the "Trip Code" part of the inverter information screen
Reason for activation	This is detected through serial communication with the inverter
Reset	With elimination of the alarm on the inverter
Reset mode	Automatic, with a number of occurrences per hour smaller than or equal to PAL23
	Manual, with a number of occurrences per hour greater than PAL23
Alarm icon	Flashing
AlarmLog	YES
Devices	**Behaviour in the event of an alarm**
Compressor in alarm	Always switched off
Other compressors	They follow their control
Other devices	They follow their control

4.5.4 Alarm for compressor operation outside envelope

Alarm code	**AL120**
Reason for activation	Operating conditions outside the envisaged envelope
Reset	When the compressor is switched off
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	YES
Devices	**Behaviour in the event of an alarm**
Compressor in alarm	After switch-off, it gets restarted following the regulation.
Other devices	They follow their control

4.5.5 Inverter offline alarm

Alarm code	**AL62**
Reason for activation	Disconnection of the serial connection with the inverter
Reset	Restoration of the serial connection
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	YES
Devices	**Behaviour in the event of an alarm**
Compressor in alarm	Always switched off
Other devices	They follow their control

4.6 Probe error alarms

The temperatures and pressures that concern the management of the unit are measured through the analogue inputs of the controller.

The software application manages the signals detected by the analogue inputs and checks that they fall within the set operating range.

If the detected signal is outside the operating range, the controller indicates the error and acts accordingly.

The alarms generated by the controller as a result of incorrect reading of the analogue inputs are shown below.

4.6.1 Temperature probes

Discharge gas temperature probe error

Alarm code	**AL24**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

User inlet water temperature probe error

Alarm code	**AL25**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Bypass temperature probe error

Alarm code	**AL126**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit pump	Operation at the set speed in manual mode
Bypass valve	Where fitted, operation is according to the opening percentage setpoint in manual mode.
The other devices	They follow their control

User outlet water temperature probe error

Alarm code	**AL27**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Temperature probe alarm in compressor motor

Alarm code	**AL130**
Reason for activation	In cases when the value measured by the controller is outside the set operating range
Reset mode	Automatic in cases when the value is within the set operating range
Alarm icon	Yes
AlarmLog	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	The min. compressor frequency is limited.
The other devices	They follow their control

Ambient air temperature probe error

Alarm code	**AL31**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Free cooling function	Deactivated
Dynamic set point	Deactivated if depends on the air temperature
The other devices	They follow their control

Coil temperature probe error

Alarm code	**AL32**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressors	Only the compressors of the circuit involved are switched off
The other devices	They follow their control

Suction temperature probe error

Alarm code	**AL36**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Multilogic system inlet and outlet water temperature probe error

Alarm code	**AL56 System inlet temperature; AL57 System outlet temperature**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	All the units change from Multilogic operation to stand-alone operation
The other devices	They follow their control

4.6.2 Pressure probes

Error in condensing pressure probes

Alarm code	**AL34**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Error in evaporating pressure probes

Alarm code	**AL35**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Error in liquid pressure probes

Alarm code	**AL128**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

Pressure probe error in system delivery and return lines

Alarm code	**AL124 System delivery line; AL125 System return line**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit pump	Operation at the set speed in manual mode
Bypass valve	Where fitted, operation is according to the opening percentage setpoint in manual mode.
The other devices	They follow their control

Error in pressure sensor of heat exchanger

Alarm code	**AL40**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit pump	Operation at the set speed in manual mode
Bypass valve	Where fitted, operation is according to the opening percentage setpoint in manual mode.
The other devices	They follow their control

Error in oil filter pressure probes

Alarm code	**AL129**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Compressor	Off
The other devices	They follow their control

4.6.3 Analogue input signals

Dynamic set point signal error

Alarm code	**AL41**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Dynamic set point	The set point value will correspond to the highest limit if the measured value is higher than the maximum value
	The set point value will correspond to the lowest limit if the measured value is lower than the minimum value
The other devices	They follow their control

Current measurement error by input probe

Alarm code	**AL42**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value measured by the analogue input falls within the set operating range
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Limitation of refrigeration capacity	The limitation managed by the drawn current is deactivated
The other devices	They follow their control

4.7 System alarms

The unit can be incorporated in a system where it is required to communicate with other controllers serially.

Where communication problems occur, alarms are managed that vary according to the system type.

4.7.1 Alarms in Multilogic and Multifree systems

The alarms linked to this function trigger whenever a problem is experienced with the Master setup parameters, the network communication, the status of the featured Slave units, and the additional probes connected to the Master.

Communication alarms

AL8	**Units not aligned**
Reason for activation	It is displayed in the Master unit when one or more connected Slave units are not available for operation. AL15 appears if a Slave unit is OFF from the keyboard or a digital input or if the mode of a Slave unit is set differently from the Master.
Reset	When operation of the Slave unit that generated it is restored
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Master	Follows the control and divides the required capacity on the connected Slave units
Other units	They follow their control

AL9	**Master communication error**
Reason for activation	It is displayed in the Slave units when there is no communication with the Master.
Reset	When communication is restored
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Master	If a Slave is not communicating, the Master follows the setpoint and splits the required capacity to the connected Slave units.
	If the Master remains isolated, it either operates autonomously or remains in standby, according to the value set in parameter MS4.
Other units	The Slave units connected follow the setting of the Master.
	Slave unit alarmed - it either operates autonomously or remains in standby, according to the value set in parameter MS47.

Probe alarms

AL55	**System input temperature error (Multilogic)**
AL56	**System output temperature error (Multilogic)**
Reason for activation	When the value measured by the analogue input is outside the set operating range.
Reset	When the value measured by the analogue input falls within the set operating range.
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	All the units change from Multilogic operation to stand-alone operation
The other devices	They follow their control

4.7.2 Alarms in systems with Smart Link+ function

Alarms connected to this function warn about communication failure between the refrigerant unit and the ventilating units, with respect to the set-up parameters.

Communication alarms

AL138 ... AL147	**Ventilating unit AHU1 ... AHU10 offline**
Reason for activation	This alarm appears when no ventilating unit is connected to the allocated address.
Reset	Connect the ventilating unit if it is not connected.
	Set the correct serial address.
	Disable the unit connected to the alarmed address.
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Operation continues with the other units that are correctly connected.

4.7.3 Alarms in systems with Smart Link DX function

The alarms connected to this function warn about communication failures between the refrigerant unit and the ventilating units, and about the min. air flow rate in the different cycles against the set-up parameters.

Serial communication alarm

AL156	**Gold unit offline**
Reason for activation	Failure in serial communication with the “GOLD” unit after the delay setpoint in parameter “SML43”
Reset	Serial communication with “GOLD” unit to be restored
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Unit shutdown

Air flow rate alarms

AL153	**Air flow rate in Gold unit lower than min. value during operation**
Reason for activation	The air flow rate of the “GOLD” unit is smaller than the setpoint in parameter “SML38” for longer than the time set in parameter “SML41”.
Reset	When the air flow rate of the “GOLD” unit is greater than the sum of the setpoints in parameters “SML38” and “SML40”
Reset mode	Automatic; switches to manual after the trip occurrences per hour set in “SML42”
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Unit shutdown

AL154	**Air flow rate of Gold unit lower than min. value during defrost cycle**
Reason for activation	The air flow rate of the “GOLD” unit is smaller than the setpoint in parameter “SML39” for longer than the time set in parameter “SML41”.
Reset	When the air flow rate of the “GOLD” unit is greater than the sum of the setpoints in parameters “SML38” and “SML40”
Reset mode	Automatic; switches to manual after the trip occurrences per hour set in “SML42”
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Unit shutdown

5 FAQ

Frequently Asked Questions
The necessary instructions for working on the controller, with regard to the main functions of the unit, are given below.

5.1 Switching the unit on and off

The user can switch the unit either on or off from the display or via an external signal, as well as from the time bands and serially.

5.1.1 Switch the unit on and off from the display.

Use the “On/Off” icon on the main screen to go to the screen where the buttons to start and stop the unit are featured.

The top area of the screen shows the status of the unit: the “On/Off” icon is provided in the central area.

A tap on the icon changes the status of the unit from “on” to “off” and vice versa.

When the unit switches status, the On/Off icon goes from green (unit ON, in operation) to white (unit OFF).

5.1.2 Switch the unit on and off from external OK signal

In order to switch the unit on and off from external OK signal, make sure the feature is active.

To switch the unit on, close the external OK signal. To switch it off, open it.

The external OK signal should be connected to terminals "1" and "2" present in the terminal board.

The external OK signal must be a potential-free contact.

5.1.3 Switch the unit on and off from the BMS

In order to switch the unit on and off from the BMS, make sure the feature is active.

See dedicated BMS management document.

5.2 Change of set points

5.2.1 Editing the setpoint from the keypad

The setpoint is displayed in the bottom part of the main screen.

The icon “-” and “+” on the sides of the setpoint are used to adjust the setpoint.

If the setpoint needs to be edited, a click on the setpoint value causes the keypad to get enabled.

Set the new value and apply the green tick to confirm.

5.2.2 Editing the setpoint from the BMS

Setpoints can be edited from the BMS only if this function is enabled.

See dedicated BMS management document.

5.2.3 Change of the set point from external OK signal

If the unit is configured with two setpoints from an external OK signal, the first setpoint is active when the physical contact is open and the second setpoint is active when the physical contact is closed.

Terminals "200" and "206" are present in the terminal board for connection of the external OK signal.

The external OK signal must be a potential-free contact.

5.3 “ACS” management

5.3.1 How to enable and disable the function from the keypad and how to edit setpoints

If the unit features this function, the icon “DHW” is enabled on the bottom right-hand side of the main screen. The function is disabled if the icon is crossed out and it is active when the icon is red.

The “DHW” icon gives access to the main screen of this function. The main screen is also used to edit the setpoint.

The “Commands menu” on the top left-hand side of the screen opens a drop-down menu with the “DHW” and “Time bands” icons.

The “DHW” icon gives access to the screen where the “ACS” function and the air conditioning system can be enabled/disabled. On this screen, the arrow on the right gives access to the list of parameters of the function. The parameters include those required to control the anti Legionella cycle.

The “Time bands” icon is used to manage the time bands for energy saving on domestic hot water.

The main parameters and a graphic representation of the function are displayed by clicking the “DHW” icon in the “User Menu”.

5.3.2 How to enable and disable the “ACS” function using an external OK signal

If you wish to enable/disable domestic hot water production using an external OK signal, you must check that the function is featured.

If the unit is configured for “ACS” function activation using an external OK signal, the function is enabled when the physical contact is closed and it is not enabled when the physical contact is open.

Terminals “1” and “9” are present in the terminal board for connection of the external OK signal.

The external OK signal must be a potential-free contact.

If the unit is configured for “ACS” function activation using an external OK signal, the controller requires that the external physical contact be closed and the OK signal from the keypad be activated to control the function.

5.3.3 How to enable and disable the air conditioning system using an external OK signal

In units featuring the “ACS” function it may be useful to have the option to enable/disable operation of the air conditioning system using an external OK signal.

If you wish to enable/disable the air conditioning system using an external OK signal, you must check that the function is featured.

If the unit is configured for activation of the air conditioning system using an external OK signal, the function is enabled when the physical contact is closed and it is not enabled when the physical contact is open.

Terminals “1” and “7” are present in the terminal board for connection of the external OK signal.

5.4 Management from BMS

5.4.1 RS485 serial connection

The connection must be made through serial port **“RS485 C”** using terminals 103, 104 and 105 and observing the indicated polarities.

Terminal "103", marked with "gnd", should be used only if you are certain it is not earthed.
The serial communication works even without its connection.

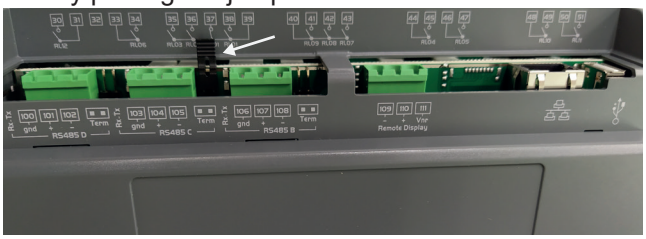
Connection of the "gnd" terminal to earth will damage the controller with consequent shutting down of the unit.

5.4.2 RS485 serial line

Starting from the Master, the serial connection must be made by connecting one unit after another on the terminals of the relevant board in accordance with standard RS-485.

No more than two wires can be present on the same terminal.

The end of line impedance can be inserted using the jumper in the board only if the unit is the last slave of the serial line.
The jumper is normally inserted in only one of the two connectors.
The end of line impedance is inserted by placing the jumper on both connectors.



The picture shows the locking jumper in serial port RS-485 C.

5.4.3 Enable ON/OFF from the BMS

The following instructions must be followed to enable unit ON/OFF from the BMS.
Select the “Parameters” icon in the Service menu. When in the “Parameters” menu, select the group “SP - Setup”.
Set parameter "SP6" to "1".

With activation of "ON/OFF" from the BMS, activation from the keypad and from digital input remain active.
To start the unit, there must be the OK signal of all of them, but to stop it, the absence of just one OK signal is sufficient.

Enabling of "ON/OFF" from the BMS prevents the change of set point from the keypad.

5.4.4 Enable the change of operating mode from the BMS

In heat pump units, for the change of operating mode from cooling to heating and vice versa from the BMS, besides setting parameter "SP6" to "1", as described in the previous point, it is necessary to also set parameter "SP9" to "0".

Enabling of the change of operating mode from the BMS prevents the change of operating mode from digital input.

Enabling of the change of operating mode from the BMS prevents the change of set point from the keypad.

5.4.5 Enable the change of set point from the BMS

In heat pump units the setpoint can be edited from the BMS. The following instructions must be followed to enable the function.

Select the “Parameters” icon in the Service menu. When in the “Parameters” menu, select the group “SP - Setup”.

Set parameter "SP6" to "1".

Refer to the dedicated BMS management document as regards the variables involved.

Enabling of "ON/OFF" from the BMS prevents the change of set point from the keypad.

5.4.6 Enable the change of operating mode from I/O

In heat pump units it is possible to enable switching of the operating mode from cooling to heating, and vice versa, using a digital input. The following instructions must be followed to enable the function.

Select the “Parameters” icon in the Service menu. When in the “Parameters” menu, select the group “SP - Setup”.

Set parameter "SP9" to "1".

5.5 Resetting of partial counters

5.5.1 Resetting the compressor hours of operation and starts

The number of compressor hours of operation and starts can be reset in the password-protected Service menu or in the Maintenance menu.

First, access one of the two menus above and then select “Compressors”.

The screen features the following selections: “Hours of operation” and “Starts”.

The selected option gives access to the screen where the related counters are reset.

If the unit is fitted with multiple compressors on multiple refrigerant circuits, the arrow buttons can be used to select the compressor whose counter needs resetting.

Click the green thumb icon to reset the counter and to go back to the previous screen; the red thumb icon gives access to the previous screen only.

The maintenance branch is password protected.

The password is "200".

5.5.2 Resetting of the number of hours of operation of the pumps

The number of pump hours of operation can be reset in the password-protected Service menu or in the Maintenance menu.

First, access one of the two menus above and then select “Pumps”.

The screen features the following selections: “Hours of operation”.

Once selected, the option gives access to the screen where the related counters are reset.

If the unit is fitted with multiple pumps, the arrow buttons can be used to select the pump whose counter needs resetting.

Click the green thumb icon to reset the counter and to go back to the previous screen; the red thumb icon gives access to the previous screen only.

The maintenance branch is password protected.

The password is "200".

5.6 Controller functions

5.6.1 Change language

The “User Menu” icon enables a drop-down menu where all the function icons are featured.

A click on the “Languages” icon gives access to the screen where a list of the available languages is given.

A click on the language name or its flag causes switching to a new language.

5.6.2 Change date and time

The unit must be Off to edit the date and the time.

When the unit is off, a click on the area where the time and the date are displayed on the main screen gives access to the edit screen.

Select the write icon in the bottom right-hand side to access the edit screen.

The keypad appears when the values of the time and the date are tapped individually. Use the keypad to set up the value you wish to edit and then tap the green save icon on the bottom right-hand side of the keypad to confirm.

After all the necessary changes have been made, tap the green icon on the bottom right-hand side of the screen to update the values.

The controller gets restarted as soon as the updated value is confirmed by pressing the green “OK” icon.

Controller restarting takes a couple of minutes.

5.6.3 Change of the settings of the "BMS" serial communication

Since these updates require a reboot of the controller, the unit must be "OFF" in order to do them.

Select the “Control panel” icon in the Service menu. Once in the “Control panel” menu, select “System information”.

Access is thus gained to the screen where the serial communication parameters can be edited.

After making the change, wait for the controller to restart, which will take about 60 seconds.

5.6.4 Recovery of the “Service” password

The password is available on the SAP portal

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CM-A-S-0000-SW-KTM-LT-EN-06-02-2025-rev01

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