ML-MF

EN

Service

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MULTILOGIC

MULTIFREE

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1 INTRODUCTION

Some information on the use of this manual.

1.1.1 Purpose of the manual

This manual is intended to provide detailed information on system management functions, such as Multilogic, Multifree and Multilogic with multi-purpose units, which are available for all units supplied with an advanced controller.

Operators given access the system and each individual unit must need to be authorised and qualified as set forth in the reference standards and must have knowledge as required to carry out any necessary operation throughout the technical life of the system/unit concerned.

This manual is addressed to highly qualified staff who have in-depth knowledge of the installed units and good knowledge of the basic principle of operation of hydraulic systems.

When carrying out any work on the unit, it is absolutely essential to comply with the applicable regulations and the indications and precautions set out in the specific software, hardware, installation, operating and maintenance manuals for each individual unit.

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 Graphic conventions

The controllers with which the units are fitted are provided with a graphical display with eight buttons.

The symbols used in the display help the user easily identify the active functions and the operating status of the unit.

The eight buttons are multi-functional buttons and their action is illustrated by the symbol above each of them.

Below is a list of the symbols appearing on the display and their functions, which are referenced in the descriptions provided in this manual.

For a comprehensive description reference must be made to the manuals of the controllers installed in each unit.

1.1.1 Button symbols

Below is a list of symbols appearing on the relevant buttons, with their definitions.

ESC "Esc" button

ENTER "Enter" button

"Arrow up" button

"Arrow down" button

"Arrow lh" button

"Arrow rh" button

MULTI LOGIC "Multilogic" button

MULTI FREE "Multifree" button

"Freecooling" button

1.1.2 Function symbols

Below is a list of symbols appearing in different areas of the display.

When the icon flashes, there is an active alarm.

"Control panel" icon

2 MULTI-UNIT SYSTEMS

2.1 General

Large projects in which the heat capacity is to be split among multiple units are more and more frequent.

Any system consisting of two ore more than two units in parallel should mainly be designed to meet the requirements below:

- to supply the required capacity at the right time;
- to guarantee max. system reliability;
- to optimize overall operation.

The solution recommended by Swegon is an integrated management system known as **Multilogic**, which is specifically designed for units featuring an advanced controller with “iPro” microprocessor.

3 MULTILOGIC

The Multilogic function manages multiple chiller, heat pump or multi-purpose units **in hydraulic parallel** for the production of cold or hot water.

The solution is designed for connection of up to 32 units by way of a TCP/IP Modbus protocol using an Ethernet switch.

This system requires that one unit operates as MASTER and the other units as SLAVE where the Master unit queries the other Slave units and defines their operating mode.

If there is no communication between the units, they can continue to work or go into standby mode, while awaiting commands from the Master or from the technical support personnel.

3.1 Principle of operation of the Multilogic system

The operating logic of a Multilogic system is essentially based on 3 distinct steps which are continuously performed by the control logic.

STEP 1 Thermoregulation

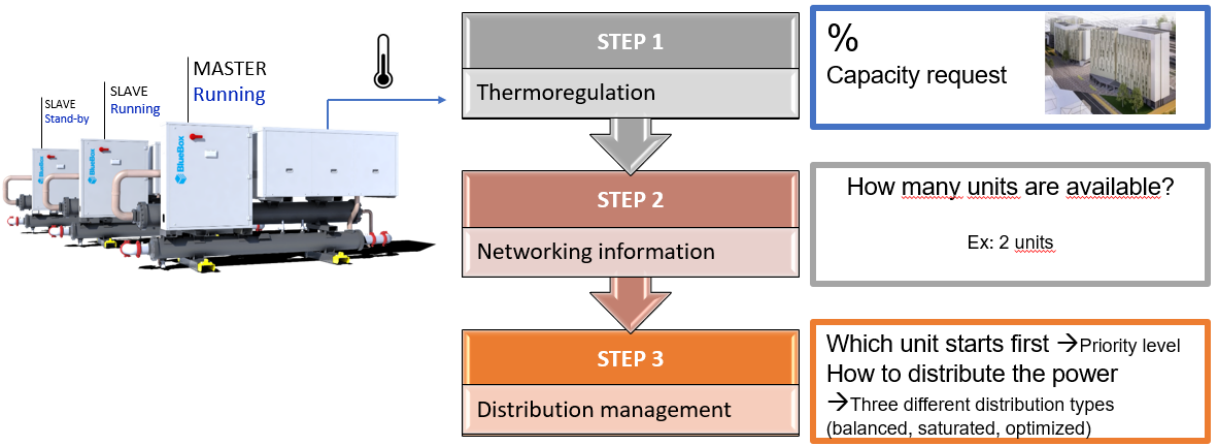
- During thermoregulation, the probes that monitor the Multilogic system are connected to and controlled by the Master unit. The probes are placed at common points on the system delivery and return lines and the Master unit calculates a capacity demand, based on the values measured by the control probe.

STEP 2 Networking

- The Master unit subsequently communicates with the other Slave units to understand how many of them are available.

STEP 3 Capacity distributions

- The required capacity is split among the available units according to the distribution logic that has been preset in the system and to the preset priority level of the units.



3.2 Multilogic: alternatives and constraints

Multilogic systems only operate with the “Ipro” advanced controller if the connected units **have the same** software version.

A Multilogic network cannot operate with different software versions/releases.

Connections with the following **are** admitted in a Multilogic system:

- Chiller and Chiller Freecooling units (CH and CH+FC), all units to be either air/water or water/water, without limitations with respect to size or compressor type;
- Chiller and Heat Pump units (CH and HP), all units to be either air/water or water/water, or combined air/water and water/water, without limitations with respect to size or compressor type;
- multi-purpose units only, without limitations with respect to size or compressor type.

The Multilogic system **is not designed** to manage:

- ACS;
- heat recovery;
- external DRY COOLERS (external Freecooling systems).

In this case, please note that the Multilogic system **does not have** a shared logic controlled by the Master unit for these options. Units featuring an ACS option or a recovery option may be fitted in units that are networked in the Multilogic system. Similarly, external Freecooling or Dry Cooler systems may be fitted, but they are not controlled by the Multilogic network. An assessment of the various situations shall be needed on a case by case basis in order for the Multilogic system and the above external options/systems to work properly.

The Multilogic system **is not compatible** with:

- Smartlink;
- Flowzer VD,VPS e VFPP;
- PFP, user-side pump with pulse function;
- systems featuring CH+FC and HP units or multi-purpose units together with CH, CH+FC or HP units.

These options must **not** be mounted within a Multilogic network. The Flowzer VP or Flowzer VDE option is the only one that can be fitted together with the Multilogic option because it operates similarly to an on/off pump, although it is supplied with an inverter-controlled pump. In this case, however, the co-existence of these options should be examined in advance in order to evaluate any potential difference in the flow rates.

3.3 Parameters

All parameters involved in the setup of the Multilogic function are listed in the following tables, sorted by their relevant group, where a basic description is also provided to explain the meaning of each parameter concerned. An additional column specifies whether the parameter needs to be edited/monitored on all units, on the Master unit only or on the Slave units only. This should help the user understand more easily the settings described below. Please note that **the most frequently used parameters** are described in depth in the following sections.

If units are networked in the Multilogic system, each unit must be left ON. The Master unit controls which units will receive the required capacity and be operational and which ones will not (i.e. units with compressors and pumps off).

When the setup parameters of the Multilogic function are edited, the unit must be “OFF”. If it is not, restarting of the controller may occur.

3.3.1 CF – Configuration parameters

Change to be made in	Parameter	Description / Additional notes
All units	CF11	*Network configuration*
		0 - Stand-alone
		1 - Master
		2 - Slave
		In the Multilogic network the value of CF11 identifies the type/role of the unit. When CF11 is set to 1, the unit is the Master unit; when CF11 is set to 2, the unit is a Slave unit. When CF11 is set to 0, the unit is excluded from the Multilogic network.

3.3.2 PA – Pumps parameters

Change to be made in	Parameter	Description / Additional notes
All units	PA1	*User - User-side pump management*
		1 – Continuous operation
		2 – Compressor-dependant operation
		When in a Multilogic network, **“PA1” must be set to 2** as the number of pumps ON must be controlled by the Master unit, depending on PA20 and on the number of units actually having the compressors ON. PA20 becomes the priority if no compressors are ON in the entire network. If “PA1 = 1”, the water pump is always ON and it is not controlled by the Master unit.
All units	PA2	*User - Compressor activation delay from pump start-up*
		Range 0 .. 999 x 10s
		This parameter identifies the delay elapsing between activation of the water pump/valve on the user side and actual compressor start-up. This parameter should be checked with special care in units with valve on/off control, according to the valve opening/closing times.
Master	PA20	#Ii# User - Number of units with user-side pumps active, when all system compressors are OFF.
		Range: 0 .. MS2.
		Although the compressors are OFF, however, water circulation must be active in order for the system probes to always give a reading that corresponds to the actual temperature. PA20 is used to set the number of pumps in operation when no unit has the compressors ON. It is only effective if all the units networked in the Multilogic system also have “PA1 = 2”.
All units (water/water)	PA24	*Source – Source-side pump management*
		0 – Missing (pump not controlled)
		1 – Continuous operation
		2 – Compressor-dependant operation
		If the Multilogic network has water/water units, **PA24 must be set to 2** as the pump in the unit must switch ON only when at least one compressor in the unit is ON. When “PA24 = 1”, the source-side pump stays on even if the compressors are OFF.

Change to be made in	Parameter	Description / Additional notes
Master	PA37	*User - Number of units with pumps active when at least one plant compressor is ON.*
		Range: 0 .. MS2.
		In order for the plant probes to always give a reading that corresponds to the actual temperature, water circulation must be active. PA37 sets the min. number of pumps in operation when at least one compressor is ON. **"PA37" must be left/set = 1**

3.3.3 PAL - Alarms parameters

Change to be made in	Parameter	Description / Additional notes
All units	PAL103	*User-side flow switch with pumps – alarm delay at pump startup*
		Range 0 .. 999 s
		This parameter is used to control the delay in the flow alarm when the pump or valve on the user side is on/off. The need may arise to increase the value, especially with valve on/off control, according to the valve opening/closing times.
All units	PAL110	*Source-side flow switch - alarm delay at pump startup*
		Range 0 .. 999 s
		This parameter is used to control the delay in the flow alarm when the pump or valve on the source side is for a water/water unit. The need may arise to increase the value, especially when a valve is fitted.

3.3.4 SP – Setup parameters

Change to be made in	Parameter	Description / Additional notes
All units	SP9	*Chiller / Heat pump selection type*
		0 – from keypad/supervision
		1 – from digital input
		If the unit is a reversible heat pump, SP9 defines which device implements mode switching.
		MASTER: may also be set as “SP9 = 1”.
		Slave: **“SP9” must be set to 0 – from keyboard / supervision** (as the units networked to the Multilogic system must be controlled by the Master unit).
All units	SP12	*BMS serial address*
		Range: 1 .. 247
		SP12 specifies the serial address of the units that is also used in the Multilogic configuration. Please note that address 1 must be associated with the Master unit (for which the lowest address must be set); as for Slave units, the sequence of serial addresses must match the sequence of IP addresses indicated below.

3.3.5 MS – Multilogic parameters: most frequently used parameters

Change to be made in	Parameter	Description / Additional notes
Master	MS2	*Number of units inside the system*
		Range: 2 .. 32
		MS2 identifies the total number of units networked in the Multilogic system, including the Master unit. For instance, 4 is the value to be entered if the system has 1 Master unit and 3 Slave units.
Master	MS4	*Unit operation with offline alarm (AL16) - Master*
		0 - the Master unit switches to OFF.
		1 - the Master operates in standalone mode.
		MS4 defines the behaviour of the **Master** unit when it is offline and stops communications with all the Slave units.
		Master unit: MS4 must be set in according of MS47.
		Slave units: the setting of MS4 is not important

Change to be made in	Parameter	Description / Additional notes
Master	MS5	*Master Priority*
		Range: 1 .. 9
		Operating priorities may be defined for the units connected to the Multilogic system. MS5 defines the priority level of the Master unit. Level 1 is the highest priority level (major priority) and level 9 is the lowest.
Master	MS6	*Multilogic capacity distribution mode*
		0 - Balanced
		1 - Saturation
		2 - Optimised
		MS6 indicates the capacity distribution mode of the Multilogic system. In other words, MS6 defines the criteria according to which capacity is shared among the various units that are connected to the Multilogic system.
Master	MS11	*Slave 1 prioritised*
	…	…
	MS18	*Slave 8 prioritised*
	MS19a	*Slave 9 prioritised*
	…	…
	MS30a	*Slave 31 prioritised*
	-	Range: 1 .. 9
		As is the case with the Master unit, operating priorities can also be defined for the units connected to the Multilogic system. Parameters from MS11 through MS30a define the priority level starting from Slave 1 through Slave 31 (for a total of 32 units, including the Master). Level 1 is the highest priority level (major priority) and level 9 is the lowest.
Master	MS31	*Daily unit rotation at (time)*
		This parameter defines the time in the day at which the backup units are rotated if unit rotation is set to occur at a preset time. Rotation is set to occur at 10-minute intervals.
Master	MS32	*Daily unit rotation every (day)*
		This parameter is used to set the day in the week on which the backup units are rotated and the rotation interval that may be every one, two, three, four or five weeks on the desired day.
Master	MS43	*“Optimized” capacity distribution - Percentage capacity steps after step MS44*
		Range: 0 .. 100%.
		This parameter defines the threshold at which capacity starts being distributed to the next units when optimised mode is set. It is used in the steps following step one.
Master	MS44	*“Optimized” capacity distribution - First capacity step percentage*
		Range: 0 .. 100%
		This parameter defines the first saturation threshold at which capacity starts being distributed to the next units when optimised mode is set. It is used in the first step.
All	MS47	*Action of (Slave) unit with “communication error”*
		0 - AutoPowerOff.
		1 - Stand Alone
		MS47 defines the behaviour of the **Slave** unit when it is offline and stops communication with the Master. This parameter must be set on the Master unit as well, in other words on all units.
Master	MS49	*Chiller setpoint*
		Range: MS50 .. MS51
		This setpoint must be set up when the Multilogic operates in chiller mode. It must be set taking into account that the system outlet temperature “Tout” (or the common delivery temperature of the system) is being monitored and based on the system requirements and functional limits.

Change to be made in	Parameter	Description / Additional notes
Master	MS52	*Heat pump setpoint* Range: MS53 .. MS55 This setpoint must be set up when the Multilogic operates in heat pump mode. It must be set taking into account that the system outlet temperature “Tout” (or the common delivery temperature) is being monitored and based on the system requirements and functional limits.
Master	MS55	*With NZ or PID, activation area offset, in chiller mode* Range: 0,1 .. 25,5°C. This parameter defines the band to calculate the compressor activation times in chiller mode when the reference temperature exceeds “MS49+MS67”. It must be set up according to the system requirements.
Master	MS56	*With NZ or PID, activation area offset, in heat pump mode* Range: 0,1 .. 25,5 °C. This parameter defines the band to calculate the compressor activation times in heat pump mode when the reference temperature is below “MS52-MS68”. It must be set up according to the system requirements.
Master	MS57	*With NZ or PID, de-activation area offset, in chiller mode* Range: 0,1 .. 25,5 °C. This parameter defines the band to calculate the compressor de-activation times in chiller mode when the reference temperature is below the setpoint specified in “MS49”. It must be set up according to the system requirements.
Master	MS58	*With NZ or PID, de-activation area offset, in heat pump mode* Range: 0,1 .. 25,5 °C This parameter defines the band to calculate the compressor de-activation times in heat pump mode when the reference temperature exceeds the setpoint specified in “MS52”. It must be set up according to the system requirements.
Master	MS67	*With NZ or PID, band in chiller mode* Range: 0,1 .. 25,5 °C MS67 is the neutral zone in chiller mode. When the temperature ranges between setpoints “MS49” and “MS49+MS67”, the thermoregulation system calculates the required capacity demand increase at a manufacturer-set percentage only if the capacity demand is greater than 0%, otherwise the increase will be 0%. It must be set up according to the system requirements.
Master	MS68	*With NZ or PID, band in heat pump mode* Range: 0,1 .. 25,5 °C. This is the neutral zone in heat pump mode. When the temperature ranges between setpoints “MS52” and “MS52-MS68”, the thermoregulation system calculates a capacity demand increase at a manufacturer-set percentage only if the capacity demand is greater than 0%, otherwise the increase will be 0%. It must be set up according to the system requirements.
Master	MS69	*Number of backup / booster units* Range: 0 .. MS2. MS69 sets the number of units that are OFF for backup purposes during normal regulation. The value is set according to the system requirements. The Master unit actively controls a number of units equal to MS2-MS69 for thermoregulation. If the Multilogic network has 4 units and 1 is in backup mode, there are 3 units normally ON.
Master	MS70	*Enable booster function* 0 - No. 1 - Yes This parameter is used to enable or disable the booster function by which the Master unit “switches on” the units in backup if the measured temperature of the system achieves extremely high values when in chiller mode or extremely low values when in heat pump mode.
Master	MS71	*Unit rotation time* Range: 0 .. 999 hours, where 0 = rotation disabled. The purpose of unit rotation is to switch on units in backup and to switch off units that are ON: it is implemented as soon as the number of hours of operation stored in parameter MS71 is reached.

Change to be made in	Parameter	Description / Additional notes
Master	MS74	*Set booster in chiller* Range: 10 .. 110 °C MS74 sets the max. temperature limit value beyond which the Master unit causes the backup units to get started, after the time set in MS76 has elapsed, in order to fulfil the capacity demand in chiller mode.
Master	MS75	*Booster differential in chiller* Range: 0,1 .. 25,5 °C This value is used to calculate the temperature threshold (MS74 – MS75) below which the Master unit switches off the backup units again.
Master	MS76	*Delay in booster activation in chiller/heat pump* Range: 0 .. 99 minutes MS76 is the delay time the Master unit waits before enabling the units in backup when the value of the reference temperature is such as to require the booster in either chiller or heat pump mode.
Master	MS78	*Set booster in heat pump* Range: 0 .. 70 °C This value sets the min. temperature limit value below which the Master unit causes the backup units to get started, after the time set in MS76 has elapsed, in order to fulfil the capacity demand in heat pump mode.
Master	MS79	*Booster differential in heat pump* Range: 0,1 .. 25,5 °C This value is used to calculate the temperature threshold (MS78 + MS79) below which the Master unit switches off the backup units again.

The parameters listed below too are part of the MS – Multilogic parameter group. These parameters are generally set by the manufacturer during the FAT process, based on the configuration, number and type of units contemplated in the order. Inn other words, they do not normally require editing even if they are at “service” level.

The manufacturer also defines the step for increasing and reducing the capacity demand.

3.3.6 MS – Multilogic parameters - Additional parameters

Change to be made in	Parameter	Description / Additional notes
Master	MS1	*Alarm AL15 detection delay* Range: 0 .. 60 minutes MS1 indicates the delay time in identifying that the Master unit is not aligned with one Slave unit, in other words the status of a Slave unit is not compatible with the Master unit (e.g. a Slave has been switched to OFF from the keyboard).
Master	MS8	*Delay for Master / Slave status alignment* Range: 0 .. 999 minutes MS8 defines the max. delay time admitted before an alarm message is displayed to warn about status misalignment between the Master and the Slave units. More specifically, if the Master is ON and a Slave unit is OFF, the value in MS1 defines the time required to identify a condition of failed alignment: alarm message AL15 is displayed if the Slave unit fails to switch to ON (same status as the Master) by the time stored in MS8. The same applies when the Master is in chiller mode and a Slave unit is in heat pump mode.
Master	MS45	*Master/Slave communication timeout* Range: 0 .. 999 seconds MS45 is the delay time that the Master uses to define communication missing between the Master and a Slave unit.
All units	MS46	*Delay in Master/Slave offline alarm* Range: 0 .. 999 seconds This parameter defines the delay time elapsing between missing communication between the Master and a Slave unit and alarm displaying.
Master	MS50	*Min. chiller setpoint* Range: -50 °C .. MS51 This is the min. value of the Multilogic setpoint in chiller mode.
Master	MS51	*Max. chiller setpoint* Range: MS50 .. 110 °C This is the min. value of the Multilogic setpoint in chiller mode.
Master	MS53	*Min. heat pump setpoint* Range: -50 °C .. MS54 This is the min. value of the Multilogic setpoint in heat pump mode.
Master	MS54	*Max. heat pump setpoint* Range: MS53 .. 110 °C his is the max. value of the Multilogic setpoint in heat pump mode.
Master	MS59	*With NZ or PID, max. activation time, in chiller mode* Range: MS60 .. 999 seconds This is the max. time interval to increase the percentage capacity demand when the reference water temperature exceeds “MS49+MS67”.
Master	MS60	*With NZ or PID, min. activation time, in chiller mode* Range: 0 .. MS59 seconds This is the min. time interval to increase the percentage capacity demand when the reference water temperature exceeds “MS49+MS67+MS55”.
Master	MS61	*With NZ or PID, max. de-activation time, in chiller mode* Range: MS62 .. 999 seconds This is the max. time interval to reduce the percentage capacity demand when the reference water temperature is below the setpoint stored in “MS49”.
Master	MS62	*With NZ or PID, min. de-activation time, in chiller mode* Range: 0 .. MS62 seconds This is the min. time interval to reduce the percentage capacity demand when the reference water temperature is below “MS49-MS57”.
Master	MS63	*With NZ or PID, max. activation time, in heat pump mode* Range: MS64 .. 999 seconds This is the max. time interval to increase the percentage capacity demand when the reference water temperature is below “MS52-MS68”.
Master	MS64	*With NZ or PID, min. activation time, in heat pump mode* Range: 0 .. MS63 seconds This is the min. time interval to increase the percentage capacity demand when the reference water temperature is below “MS52-MS68-MS56”.

Change to be made in	Parameter	Description / Additional notes
Master	MS65	*With NZ or PID, max. de-activation time, in heat pump mode*
		Range: MS66 .. 999 seconds
		This is the max. time interval to reduce the percentage capacity demand when the reference water temperature exceeds the setpoint stored in “MS52”.
Master	MS66	*With NZ or PID, min. de-activation time, in heat pump mode*
		Range: 0 .. MS65 seconds
		This is the min. time interval to reduce the percentage capacity demand when the reference water temperature exceeds “MS52+MS58”.
Master	MS72	*Delay in call between two networked units*
		Range: 0 .. 999 seconds
		This time interval defines the delay elapsing in unit switch-on when the Master re-distributes the requested capacity. This parameter is defined by the manufacturer and it must not be changed.
Master	MS73	*Frequency of pump activation inspection after lowest hours of operation*
		Range: 0 .. 999 s
		MS73 defines the interval at which the hours of operation of the units need to be checked while they are ON. This time value is used to recalculate the switch-on sequence of the units in the Multilogic network. Normally, it is not edited.
Master	MS80	*Delay between FC capacity demand and distribution among units*
		Range 0 .. 99 minutes
		If the demand exceeds 0% with the Freecooling function available, the Master waits for the time value stored in “MS80” before it distributes the capacity among the units in order to avoid switching them ON when it is not needed.

Parameters may be included in Multilogic network setup that are not closely related to the Multilogic network itself, but may anyway have an impact on the behaviour of the Multilogic system as they define how the devices in each single unit have to be controlled.

3.3.7 C0 – Compressors parameters

These are used to manage the unit and to switch the compressors on and off. They are not listed here as they are not directly connected to the Multilogic network parameters. However, their setup values (entered by the manufacturer) change depending on the system being a Multilogic network or a standalone unit.

3.3.8 ST – Thermoregulation parameters

They are used for unit thermoregulation. They are not listed here as they are not directly connected to the Multilogic network parameters. However, their setup values (entered by the manufacturer) change depending on the system being a Multilogic network or a standalone unit.

3.4 Multilogic: implementation of MASTER/SLAVE communication network

With the Multilogic system, the units must be connected in an Ethernet network. They communicate with each other continuously.

The connection is implemented using a network switch installed in the unit which has been identified as the Master and an Ethernet cable for the other Slave units. The cable must be at least **UTP CAT5e** or higher, with RJ45 connectors (straight or **patch type**, no “cross” type).

Each unit is correctly configured by the manufacturer to work in address class 10.2.3.X. By default, the address of the Master unit is 10.2.3.20 and the “n” Slave units follow with addresses 10.2.3.20 + “n”.

If the default Ethernet network configuration needs to be changed to another network or IT infrastructure, the following rules must be observed:

- The host IT infrastructure must guarantee the data exchange service between units, failing which alarms AL15 and AL16 will trigger, with consequent loss of efficiency in following the actual thermoregulation demand.
- The host IT infrastructure must provide the gateway service. Each unit communicates on the basis of the data exchanged by a server platform.
- The setup parameters of all units individually must be modified and suitably configured.
- For all units, the sequence of IP addresses must be observed.

The network setup parameters that need to be modified for all individual units include:

- IP address
- network screen
- network
- gateway
- DNS.

For all units, the sequence of IP addresses must be observed. For instance. If 4 units are present in a structure of addresses starting from 192.168.150, the following will apply:

- Master unit - IP address 192.168.1.150
- Slave unit 1 - IP address 192.168.1.151
- Slave unit 2 - IP address 192.168.1.152
- Slave unit 3 - IP address 192.168.1.153.

If the gateway address is 192.168.1.1, this information too must be configured in all the units. Also, for example, in the firewall of the host IT infrastructure, port 80 and Modbus TCP/IP port 502 must be open.

For correct and complete network configuration it is essential to follow the instructions given to set up parameters CF11 and SP12 described below.

3.4.1 Editing the network setup parameters using a computer

The factory-set IP address is 10.2.3.20. To connect the unit to a network, its IP address must be changed. To do this, the user must connect point-to-point with a computer.

The procedure to follow is:

- change the IP address of your computer to address 10.2.3.19
- make sure the network screen is 255.255.255.0
- Open a web browser of your PC (FireFox, IE, etc.).
- in the address bar, type 10.2.3.20/panel
- login
- enter Username = service
- enter Password = servicebb
- press the “Configure” button.

Now you can access the screen to give the controller a new IP address and the network characteristics.

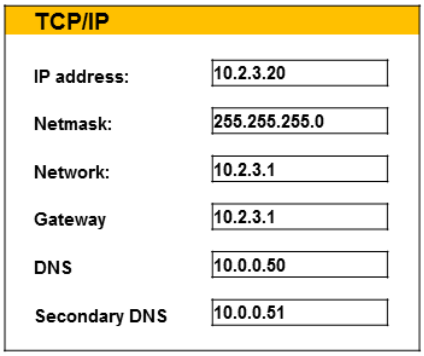


Fig. 1 Screen for changing the IP address

When accessing a “new hardware” iPro:

- enter the Username and Password above;
- select the “Network” on the left hand side of the screen to access the page where it is possible to modify the IP address and the network structure;
- modify the ETH0 port fields;
- press “Save” to save the modifications;
- “Logout” and restart the board.

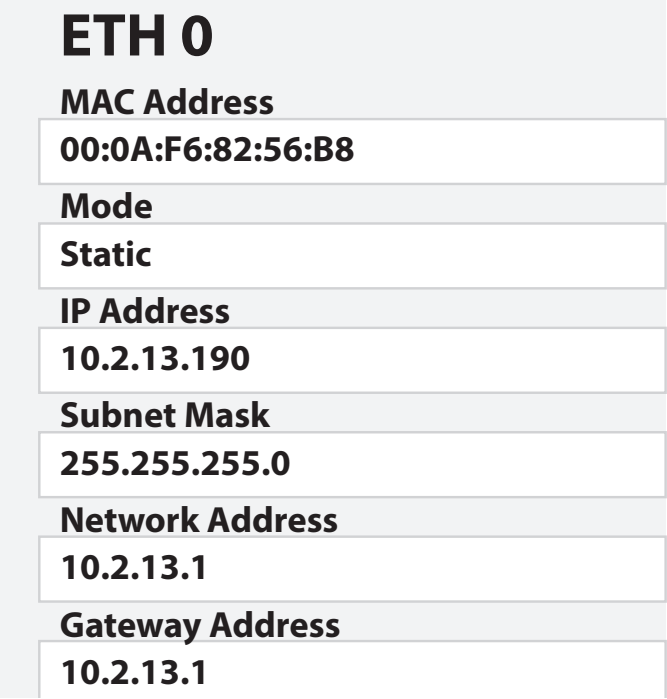


Fig. 2 Screen for modifying the IP address with “new hardware” iPro.

3.4.2 Editing the network setup parameters using a video display

The IP address of the controller can be changed easily with the help of the display screen.

As an IP address change requires that the controller be restarted, we do recommend that the unit is switched to "OFF" before making the change.

Go to the "Service" branch:

- Use the arrow buttons to select the icon “control panel” and press “Enter” to confirm.
- Click the arrow down button to select line three and press “Enter” to confirm.
- The arrow buttons are used to move in the fields that make up the IP address and to change them.

After editing the value of a field, you will have 60 seconds to finalise the change of the address before the controller gets restarted.

The countdown appears on the bottom RH side of the screen.

The change of the address is finalised when the controller is restarted.

3.4.3 Search for IP address

If you do not know the IP address of the controller, you can access the configuration screen to force a default address.

With no power to the controller, insert a jumper in the terminals marked with "JMP1" as shown in the figure.

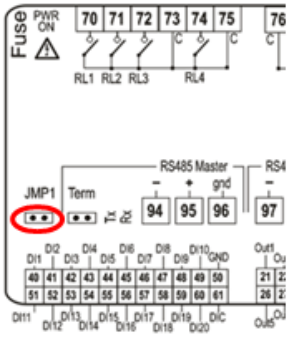


Fig. 3 Position of jumper JMP1

After inserting the jumper, power up the controller (wait about 90 seconds for it to start) and proceed as follows:

- change the IP address of your computer to address 192.168.0.249
- make sure the network screen is 255.255.255.0
- Open a web browser of your PC (FireFox, IE, etc.).
- in the address bar, type 192.168.0.250/panel
- login
- enter Username = service
- enter Password = servicebb
- press the “Configure” button.

Now you can correctly read the IP address of the controller and give it a new address if you need to.

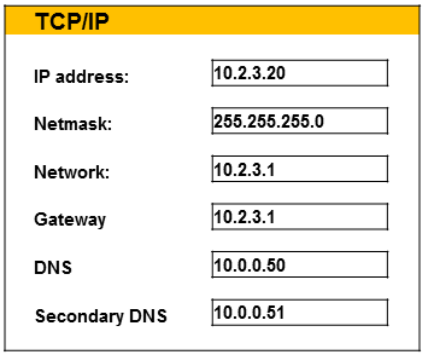


Fig. 4 Screen for changing the IP address

Now log out, switch off the controller and remove the jumper.

When accessing a “new hardware” iPro, after completing access using the Username and Password above, select the “Network” menu on the left hand side of the screen, read the controller IP address correctly and assign a new address if necessary.

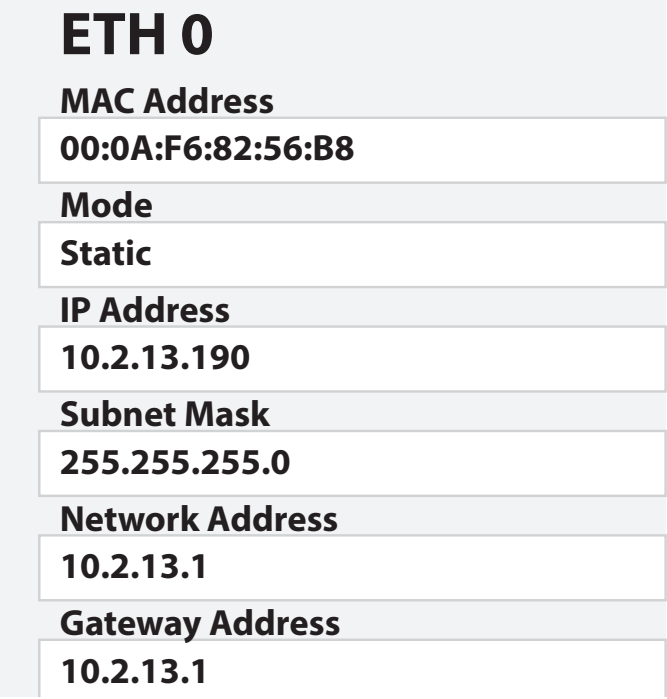


Fig. 5 Screen for modifying the IP address with “new hardware” iPro.

Now log out, switch off the controller and remove the jumper.

3.5 Multilogic: main parameters

The units are normally shipped from the factory, set by default for standalone operation. Enabling for networked operation and configuration for the required operating mode must be done by service personnel.

The lowest serial address at parameter SP12 must be assigned to the Master unit and those of the Slave units must be consecutive to it. The sequence of the serial addresses set in the units must match the sequence of IP addresses.

“Gaps” must also be prevented, in other words the values of the serial addresses must be subsequent. Please find below two examples taking into account a network with 3 units.

	VALID		
	U1 (Master)	U2 (Slave1)	U3 (Slave2)
IP	10.2.3.20	10.2.3.21	10.2.3.22
SP12	1	2	3

	NOT VALID		
	U1 (Master)	U2 (Slave1)	U3 (Slave2)
IP	10.2.3.20	10.2.3.21	10.2.3.27
SP12	1	2	8

The main parameters involved, with regard to the Master unit, are shown in the table below. Needless to say, the number of units to be set matches the number of units connected to the Multilogic network. For the Master unit, it is essential to set parameter MS2 consistently with the network to be created. In the example above, MS2 must be set to 3 as there is 1 Master unit and 2 Slave units.

Master

Parameter	Value	UM	Description
CF11	1	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP9	0/1	-	Selection type: chiller / heat pump
SP12	1	-	BMS serial address
MS2	3	-	Number of units inside the system (including Master)

In systems where both hot and cold water are produced, the Master unit must be a heat pump.

Slave 1

Parameter	Value	UM	Description
CF11	2	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP9	0	-	Selection type: chiller / heat pump
SP12	2	-	BMS serial address

Slave 2

Parameter	Value	UM	Description
CF11	2	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP9	0	-	Selection type: chiller / heat pump
SP12	3	-	BMS serial address

3.6 Multilogic: priority

The priority level of a unit in the network determines the way in which the Master delivers the required cooling capacity. The priority level, for all the units of the network, must be set in the parameters of the Master.

The priority levels must be assigned correctly in order to avoid configuration errors with the appearance of alarm "ACF13".

When assigning or changing the priority levels, pay attention to the following:

- The highest priority level (major priority) corresponds to “1” and the lowest to “9”.
- there must always be at least one unit at level “1”;
- No level can be skipped, which means there cannot be a unit at level “3” if there is no unit at level “2” in the network.
- The logic for priority level allocation mainly depends on the unit type and configuration as well as on the features of the system.

Parameter	Value	UM	Description
MS5	1	-	Master priority
MS11	1	-	Slave 1 priority
MS12	1	-	Slave 2 priority
--	1	-	Slave -- priority
MS30a	1	-	Slave 31 priority

3.7 Multilogic: capacity management

Activation of the units can be adapted to the characteristics of the plant.

An activation sequence can be defined by assigning a priority to each unit or group of units: the activation procedures within a group having the same priority can also be defined.

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

Parameter	Value	UM	Description
MS6	2	-	Multilogic capacity distribution mode (0=Balanced; 1=Saturation; 2=Optimized)
MS43	25	%	‘Optimized’ capacity distribution – Percentage of capacity steps after step MS44
MS44	50	%	‘Optimized’ capacity distribution – Percentage of first capacity step

Units with highest priority will be started up first.

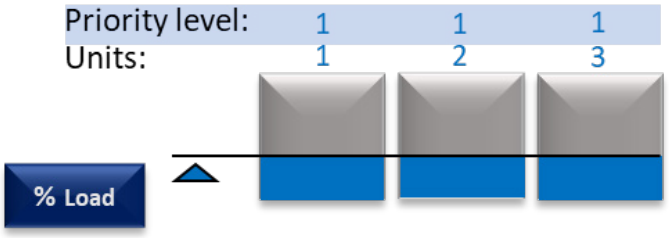
The methods with which units with the same priority are activated are:

- Balanced;
- Saturation;
- Optimised.

3.7.1 Balanced

Parameter MS6 = 0

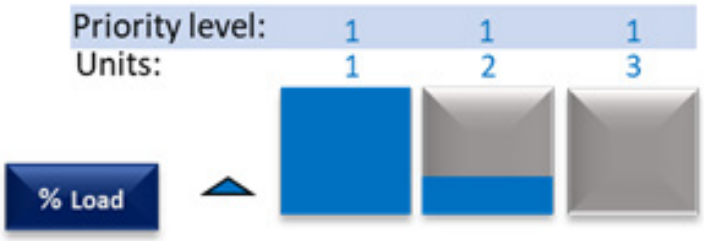
All units with the same priority, starting from those with the highest level “1”, increase the capacity in parallel, thus favouring operation at partial loads.



3.7.2 Saturation

Parameter MS6 = 1

Units are activated one at a time and the switch-on request is output to the next unit only when the previous one is at 100%. The criterion based on which a unit is switched on/off, as opposed to another having the same priority, is the number of hours of operation. Units having a higher priority are the first involved. This solution contributes to reducing the power consumption level of the pumps, where fitted onboard each unit.

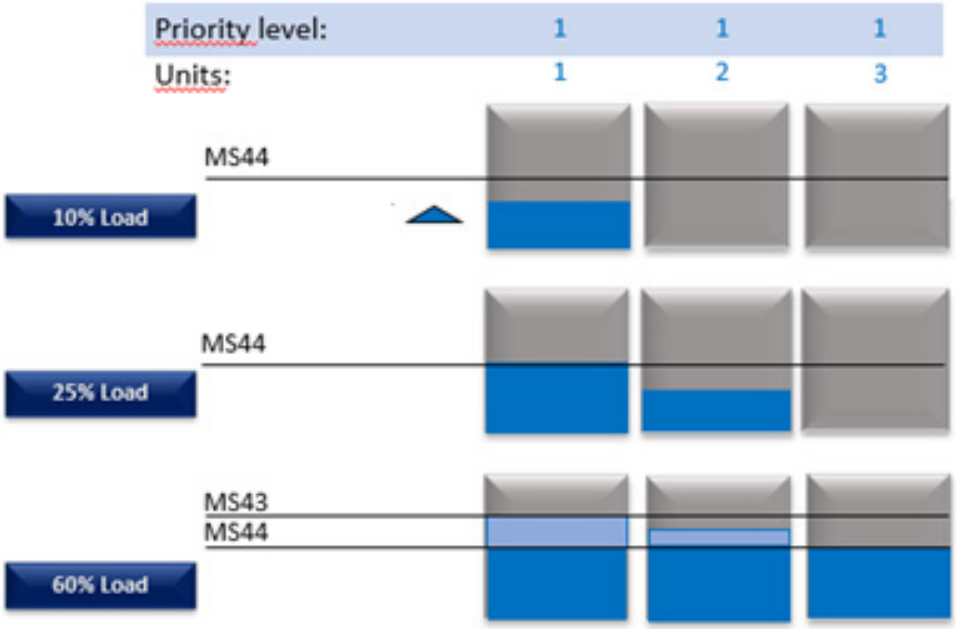


3.7.3 Optimised

Parameter MS6 = 2

Units with the same priority are started up one at a time. The activation request is output to the next unit when the previous one has reached the demand percentage set in parameter “MS44”. As soon as all the units with the same priority level have reached the same demand percentage, the capacity distribution cycle is repeated with increments that are equal to the percentage value set in parameter “MS43” until the units with the same priority level are saturated. The capacity is then distributed in the same way to the group of units with the next priority level. The switch-on/switch-off criteria of one unit compared to another, for the same priority, takes place based on the number of hours of operation.

This solution contributes to operation at partial loads and, at the same time, it helps reduce the power consumption levels of the pumps, where fitted onboard each unit.



Unless the customer has specific requirements, the "Optimized" activation mode is the one normally used in the units.

If you decide to use capacity distribution in “Balanced” mode, assess whether the value of the maximum inrush current of the system is compatible with the protective devices of the power supply.

3.8 Multilogic: thermoregulation

The controller of the Multilogic function uses a thermoregulation algorithm to adjust to the system demand the capacity provided by the Multilogic network connection.

As explained above, the parameters used to calculate the activation and de-activation times are preset by the manufacturer during the FAT process. The other parameters involved are shown in the table below. The values of the parameters are representative. In specific cases, different values can be set.

Please note that the thermoregulation algorithm uses the system outlet probe “Tout” as reference probe. No other adjustment is required at service level.

Parameter	Value	UM	Description
MS49	7.0	°C	Chiller setpoint
MS52	42.0	°C	Heat pump setpoint
MS55	5.0	°C	With NZ or PID, activation area offset in chiller mode
MS56	5.0	°C	With NZ or PID, activation area offset in heat pump mode
MS57	2.0	°C	With NZ or PID, de-activation area offset in chiller mode
MS58	2.0	°C	With NZ or PID, de-activation area offset in heat pump mode
MS67	1.5	°C	With NZ or PID, band in chiller mode
MS68	1.5	°C	With NZ or PID, band in heat pump mode

Parameters MS49, MS50, MS51, MS52, MS53 and MS54 must always be aligned with parameters ST1, ST2, ST3, ST4, ST5 and ST6.

Moreover, to have a good behavior of the plant in offline condition, it is advisable to set in standalone mode the Neutral Zone and PID control based on the outlet temperature probe for each unit.

The abbreviations in the graphs are:

- power UP = capacity increase;
- power DoWn = capacity decrease;
- NZ = neutral zone
- Tout = water temperature at the outlet of the system. This is the temperature probe on the common delivery line of the system that is connected to the Master, o BTM2, as shown in the system diagrams illustrated below.

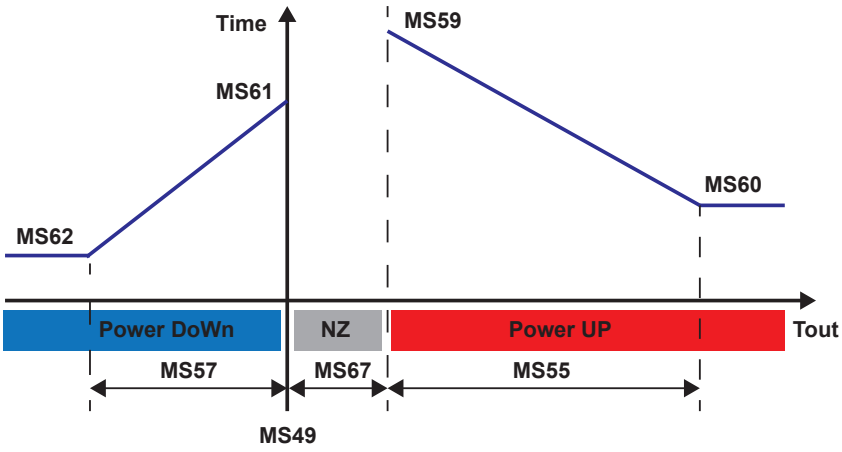


Fig. 6 Operation in cooling mode

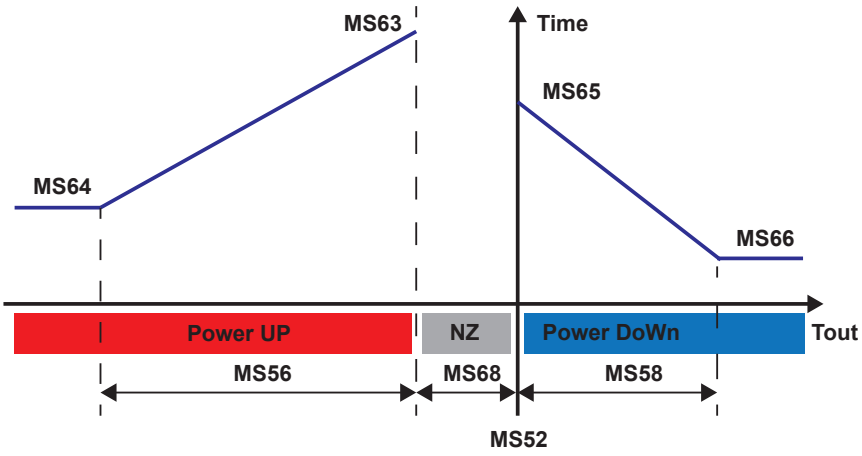


Fig. 7 Operation in heating mode

As a rule, the greater the distance from the setpoint of the “Tout” temperature, the greater the frequency at which the capacity demand is either increased or reduced.

The thermoregulation algorithm either increases or reduces the demand at predefined time intervals, as shown in the graphs above, based on the water temperature detected by the probe at the outlet of the system (“Tout”). The percentage increase/decrease in demand is **set by the manufacturer**. The required capacity value calculated in this way gives an indication of the capacity to be distributed to the various units, according to the logic defined in parameter “MS6”.

If the defined logic is the cooling logic:

- when “Tout” is in the neutral zone (“NZ”), the thermoregulation system calculates an increase in capacity only on condition that the demand already exceeds 0%, otherwise the increase will be 0%;
- when the temperature is beyond the increased neutral zone setpoint - higher than “MS49+MS67” -, the required capacity is increased after every time interval calculated according to the corresponding graph;
- when the outlet temperature is below the setpoint, the required capacity is decreased after every time interval calculated according to the corresponding graph.

In other words:

- if all the compressors are OFF (percentage demand equal to 0%) and the temperature starts to rise with reference to setpoint MS49, without however exceeding the value resulting from “MS49+MS67”, the percentage demand stays at 0% and it is not increased. If the temperature exceeds the value resulting from “MS49+MS67”, the previous graph shows that the thermoregulation system increases the percentage capacity demand at every time interval calculated according to the corresponding graph.
- As the capacity demand increases, the Master distributes the demand among the available units, according to the logic defined by parameter MS6. The result is that the compressors start switching ON and “Tout” starts being reduced. If the temperature goes back to the neutral zone and the required capacity exceeds 0%, the Master continues to increase the required capacity. The time to increase the capacity is very slow in this situation and it is set by the manufacturer;
- if the temperature drops below the setpoint, the Master starts reducing the required capacity at time intervals calculated according to the corresponding graph;
- if the temperature goes back to be within the neutral zone, the Master starts increasing again the required percentage capacity as described above;
- the final result is that the system increases and decreases the capacity by the value corresponding to the heat capacity delivered by one “compressor” around the desired setpoint;
- if the min. capacity provided by the Multilogic system is greater than the thermal load, the case may be that the setpoint is met and all compressors are disabled.

3.9 Multilogic: backup and unit rotation function

In the Multilogic function, the application allows one or more units of the system to be managed in Back-up function.

Master

Parameter	Value	UM	Description
MS69	0	-	Number of backup units

The number of Back-up units should be set in parameter MS69.

If there are units with different priority in the system, the ones with lowest priority are assigned as Back-up units.

The capacity demand of the system will be met by the Master by activating the number of units present in the system minus the number of units in Back-up.

When a unit in operation is not available, it is replaced by the back-up unit with the lowest number of hours of operation.

The max. number of units in backup depends on the requirements and redundancy based on which the system was designed. For instance. If all the installed units have the same cooling/heating capacity and the system is designed in “N + X” configuration - where “N” is the number of units required to make up for the thermal load and “X” is the number of units “in excess” required to make up for redundancy -, the total number of units fitted in the system is “MS2 = N + X” and the number of units in backup may be MS69 = X (or lower).

The number of units in backup must always be smaller than the total number of units in the Multilogic system, otherwise no unit will be ON during normal operation.

The opportunity is offered to enable rotation between units in operation and backup units. Please note that rotation only occurs between units have the same priority level as those in operation. Unit rotation takes place in two possible ways:

- rotation based on the number of hours of operation;
- rotation at fixed intervals.

The parameters concerned are illustrated below.

Master

Parameter	Value	UM	Description
MS31	12:10	hh:mm	Time of day when the unit rotation takes place
MS32	Once every two Mondays	-	Day on which the rotation takes place
MS71	0	hr	Rotation time of units

Rotation is disabled when MS71 = 0 and MS32 = Disabled.

3.9.1 Rotation based on the number of hours of operation

Rotation based on the number of hours of operation is enabled whenever parameter “MS71” is set to a value above “0”. The Master unit checks the hours of operation of the units at the frequency defined in parameter “MS73” and then recalculates the switch-on sequence based on the number of hours of operation. Rotation is implemented if the Multilogic system stays ON continuously for the time set in parameter “MS71” and the new switch-on sequence requires the unit in backup is switched on. The Master will deactivate one unit that is running and activate one of the units in Back-up. If all the units are at priority level “1” or the Master is set to a priority level that requires rotation, the Master unit too will become a backup unit.

Rotation is also possible every time the system is switched ON, i.e. whenever the Multilogic network switches from capacity demand at 0% to a capacity condition exceeding 0%. This is due to the fact that the Master unit switches on the units following the switch-on sequence after its recalculation according to the frequency defined in parameter “MS73”.

3.9.2 Rotation at fixed intervals

To enable rotation at fixed intervals, rotation based on the hours of operation must be disabled - set parameter “MS71” to “0” - and MS32 must be set to a different value than “disabled”. Whenever parameter “MS71” is different from “0”, rotation occurs based on the hours of operation, irrespective of the value set in “MS32”. The time and minutes within the 24 hours at which rotation takes place must be set in parameter "MS31” (minutes can be set in multiples of 10). Parameter "MS32" can be used to select the day in the week on which the rotation takes place and the rotation interval that may be every one, two, three, four or five weeks.

In this case, the switch-on sequence is calculated according to the hours of operation at the time specified in parameters “MS31” and “MS32”.

In the example provided in the table above, rotation takes place every two Mondays at 12:10.

3.9.3 Both types of rotation

Rotation only takes place between units that have the same priority as the units in operation. Attention must therefore be paid that the number of units in backup set in the relevant parameter is not higher than the number of units with lower priority.

Activation of the booster function with units having the same priority, which causes a rotation, may result in the cancellation of the next rotation.

Priorities may also be set with specific values to enable a partially controlled rotation. This means that units with lower priority get started last or are switched to backup.

3.10 Multilogic: booster function

The Booster function activates the Back-up units when those that are running are unable to meet the capacity demand of the system. The booster function is only enabled if the number of units in backup is **greater than 0** and **MS70 = 1**. When the booster function is disabled, the number of backup units is restored.

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

Master

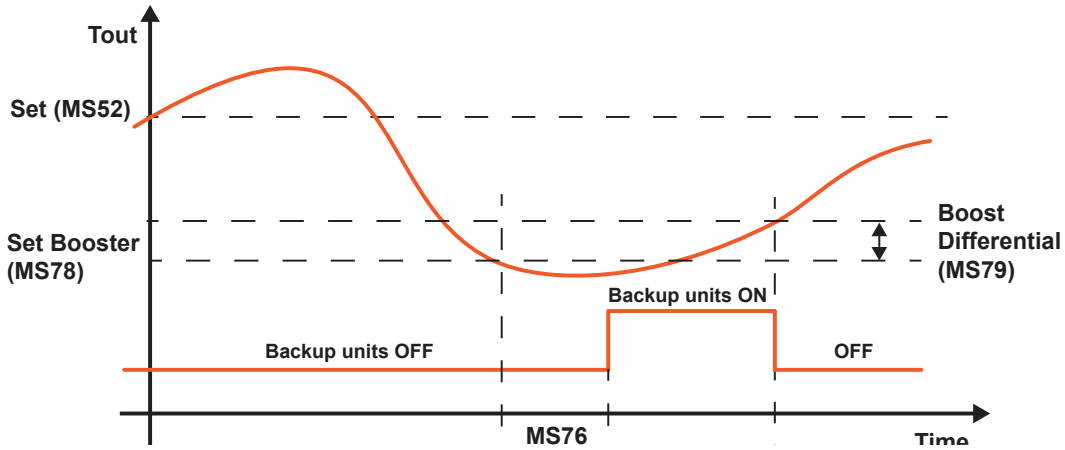
Parameter	Value	UM	Description
MS70	0	-	Enables Booster function (0 = No; 1 = Yes)
MS74	20.0	°C	Booster set point in chiller mode
MS75	5.0	°C	Booster differential in chiller mode
MS76	3	min	"Booster" function activation delay
MS78	30.0	°C	Booster set point in heat pump mode
MS79	5.0	°C	Booster differential in heat pump mode

3.10.1 Heating

After the booster function is selected (MS70 = 1), it gets enabled as soon as the reference water temperature is lower than the setpoint stored in parameter “MS78” for a longer time than set in parameter “MS76”; it gets disabled automatically as soon as the reference water temperature rises above the activation value plus the corresponding differential, which is set in parameter “MS78+MS79”. **When a unit in backup is enabled by the booster function, the capacity demand it receives is 100% and compressor switch-on is controlled according to the CO parameters of the unit.**

If the booster is activated with a request not at 100%, the backup units follow the setting set in MS6

The behaviour of the system in heating mode is illustrated by the graph below.

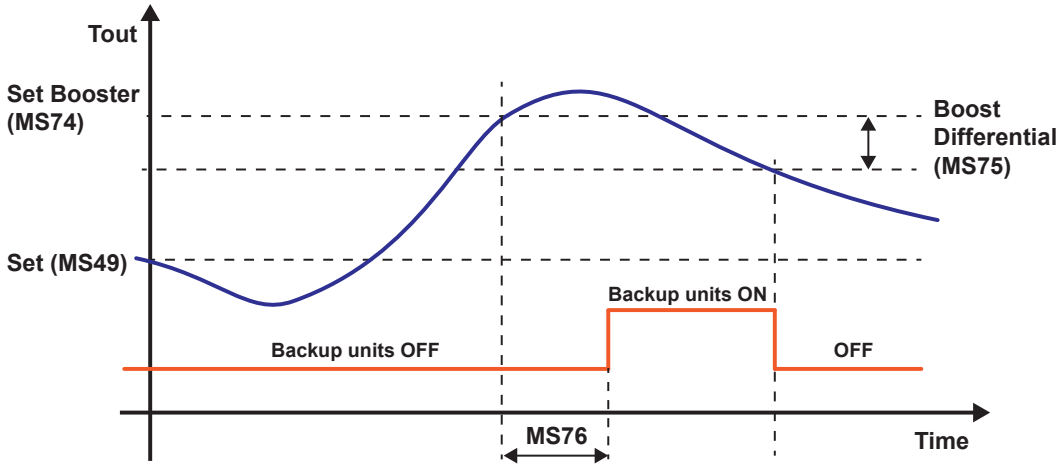


3.10.2 Cooling

After the booster function is selected (MS70 = 1), it gets enabled as soon as the reference water temperature exceeds the setpoint stored in parameter “MS74” for a longer time than set in parameter “MS76”; it gets disabled automatically as soon as the reference water temperature drops below the activation value minus the corresponding differential, which is set in parameter “MS74-MS75”. **When a unit in backup is enabled by the booster function, the capacity demand it receives is 100% and compressor switch-on is controlled according to the CO parameters of the unit.**

If the booster is activated with a request not at 100%, the backup units follow the setting set in MS6

The behaviour of the system in cooling mode is illustrated by the graph below.



3.10.3 Multilogic: examples

Please find below a few examples to better understand some possible combinations.

Example 1

- Multilogic connection with 3 units, including Master
- All units have priority level 1.
- One unit is in backup and the booster function is enabled.

The Master unit is involved in rotation and in the booster function too, when needed.

Example 2

- Multilogic connection with 3 units, including Master
- The Master unit has priority level 1 and both Slave units have priority level 2.
- One unit is in backup and the booster function is enabled.

Rotation involves both Slave units. If the booster function is enabled, the Slave unit involved is the unit in backup at that time. The Master unit is always ON.

Example 3

- Multilogic connection with 3 units, including Master
- The Master unit and one Slave unit have priority level 1 and the second Slave unit has priority level 2.
- One unit is in backup and the booster function is enabled.

Rotation does not take place because the Slave unit with priority level 2 remains in standby. The Slave unit having priority level 2 becomes operational if the booster function is selected.

3.11 Multilogic: water circulation in user system

The Multilogic system uses the outlet water probe as control probe. This is why it is important to have a min. water flow in every condition.

The parameters involved are shown in the table.

For all units

Parameter	Value	UM	Description
PA1	2	-	User – User-side pump management (0 - Not managed; 1 - Continuous operation; 2 - Compressor-dependant operation)
PA2	3	10 s	User - Compressor activation delay from pump start-up
PA24	2	-	Source – Source-side pump management (0 - Not managed; 1 - Continuous operation; 2 - Compressor-dependant operation)
PAL103	15	s	User-side flow switch with pumps – alarm delay at pump start-up
PAL110	0	s	Source-side flow switch - alarm delay at pump start-up

Added to Master only

Parameter	Value	UM	Description
PA20	1	-	Number of units with user-side pumps active, when all the compressors of the system are off
PA37	1	-	Number of units with user-side pumps running when at least one compressor is switched on in the system

All units interconnected in the Multilogic system **must have "PA1 = 2 - Compressor-dependant operation".** With "PA1 = 2", the Master unit decides how many water pumps on the user side are ON in order to ensure the min. water circulation required for correct temperature reading at the time in which the Multilogic system has met the setpoint and all compressors are OFF. When "PA1 = 2" on all the units, Master parameter PA20 will have priority over the number of user-side pumps that are ON. The pumps are also overridden to ON when an offline alarm triggers and operation is in standalone mode.

Units in which "PA1 = 1" will have the pumps ON regardless of the value set in "PA20".

Parameter **"PA24" must be set to 2** only on water/water units. This setting enables the unit to switch the source-side pump ON only when the unit has at least one compressor ON and prevents source-side pumps from being ON when this is not necessary.

As soon as the required capacity is higher than zero, water circulation follows the thermoregulation demand and parameter "PA37" identifies the number of pumps ON when at least one compressor in the Multilogic system is ON. **"PA37 = 1" is the default value set by the manufacturer.**

With the settings described above, the number of water pumps on running depends on which units have the compressors on running.

If the unit is not provided with a pump, but it has a water on/off valve, the setup parameters must be managed as if the unit had a pump. The following parameters will also need to be checked and set correctly: "PA2 = User - Compressor activation delay from pump start-up", "PAL103 = User-side flow switch with pumps – alarm delay at pump start-up" and, where necessary, "PAL110 = User-side flow switch - alarm delay at pump start-up", based on the opening/closing times of the valves in use.

The pumps that stay active when the thermoregulation value is met vary according to unit rotation. If only one pump is active, this must be the pump in the unit where the compressors get started first upon the next thermoregulation demand.

3.12 Multilogic: special conditions

During system operation, in addition to those examined above, special conditions may occur that have to do with system management.

3.12.1 No communication

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

Master

Parameter	Value	UM	Description
MS4	1	-	Unit operation with offline alarm: Master (0 = AutoPowerOff; 1 = Standalone)
MS47	1	-	Action of unit with “communication error”; Slave (0 = AutoPowerOff; 1 = Standalone)

Slave

Parameter	Value	UM	Description
MS47	1	-	Action of unit with “communication error”: Slave (0 = AutoPowerOff; 1 = Standalone)

The behaviour of the Master unit in cases when it does not receive any reply from the Slave units in the Multilogic network is determined by the value of parameter “MS4”:

- if “MS4 = 1 - Standalone”, the Master unit starts operating as if alone, i.e. the only unit in the system. In this case, the control probes, the setpoints and the control procedures are the local ones, as defined by the ST parameters for thermoregulation and PA parameters for pumps;
- if “MS4 = 0 - Auto power off”, the Master unit switches off as soon as it no longer senses the Slave units.

Parameter “MS47” defines the behaviour of a Slave unit at the time when it no longer receives communications from the Master unit and switches to “offline alarm” condition. The settable values and the different types of behaviour are the same as illustrated for parameter “MS4”. “MS47” **must** be set on all units (including the Master unit). For the Master unit, MS47 must be set in according with MS4. For the Slave units, only MS47 must be set.

Parameters “MS45” and “MS46”, which do not normally need editing, are respectively used to control the delays required to identify any missing communication first and any units offline then.

3.12.2 ACS option fitted

Although the Multilogic system does not control the ACS option, this may be fitted in Multilogic systems. Please consider that when a unit is in ACS mode, it is not temporarily available in the Multilogic management function, so the Master unit will re-calculate the distribution of the capacity demand among the units available at that specific time. If a unit is in backup mode, the Master uses it in “replacement” of the unit in ACS mode. As soon as the unit has fulfilled its ACS function, it is newly available in the Multilogic network and the Master re-calculates the distribution of the capacity demand according to the set logic, also restoring the unit in backup if it has been enabled. The ACS option is controlled independently from the backup function, in that the backup unit may be in ACS mode if it is required to operate in such mode.

3.12.3 Unit connection to network during system operation

It may happen that a unit is made available while the system is operating.

This may happen in multiple cases, e.g. when communication is restored or in other instances.

When this condition occurs, the Master recalculates the system demand and distributes the capacity to the units available at that time, according to the enabled operation logics. In this case, the Master introduces a delay time (“MS72”) between the calculation of the required capacity and the activation of a unit. Additionally, as soon as the unit is enabled, the times for unit start-up and for adaptation to the capacity demand received from the Master depend on the type of compressors fitted. As a rule, and in addition to the specific management function herein, the compressors fitted in one unit are started and shut down according to the times set in the “CO - Compressors parameters”.

The delay (“MS72”) elapsing between capacity calculation/distribution and actual switch-on is active at all times, including during normal operation; it helps prevent system fluctuations which may generate “fake demands” leading to unnecessary switch-on.

3.13 Multilogic: system types

Some examples of Multilogic connections are illustrated below. These examples consist in outline diagrams provided in the next pages, which illustrate how the Multilogic system works and include the min. requirements for correct system operation.

The Master unit in systems with heat pump units **must** be a heat pump.

It is also important that parameter SP9 “Selection type: Chiller / Heat pump” on each unit is set to “0 – From keyboard / supervision” as the Master communicates the operating mode to each unit.

The abbreviations in the four graphs include:

- M = Master unit
- S = Slave unit
- BTM2 = common temperature probe on delivery line in Multilogic system;
- BTM1 = common temperature probe on return line in Multilogic system;
- Hc = hydraulic circuit breaker or manifold
- Sc = secondary circuit
- Vnr = non-return valve
- Vw= water on/off valve;
- Pu = unit electric pump on user side (it may be one in each individual unit or one for the entire system; it may be fixed or variable flow rate, with the limitations explained above);
- Ps = unit electric pump on source side (based on the specifications for condensation control).

The yellow dotted line defines the area of action the Multilogic management function. In addition to the water probes installed on each individual unit, the system will be supplied from the factory with probes BTM1 and BTM2, which are specifically designed for the Multilogic function, wired on the Master controller. The system may be connected to an external BMS for remote monitoring. A network switch is fitted inside the Master unit to physically implement the connection between the units.

Check valves Vnr, water on/off valves Vw and any other option for the hydraulic system, such as, but not limited to, probe pockets, are not fitted in the unit and their installation at the right point in the system falls under the responsibility of the client/installer. In units without a pump, 2-way shut-off valves “Vw” can be piloted by the unit prior installation of the option “relay for external pump management” in order to have a potential-free control contact. As the valve managed is supposed to have an opening time, as described above, it will be important in this case to correctly set parameter “PA2 = User - Compressor activation delay from pump start-up”, parameter “PAL103 = User-side flow switch with pumps - alarm delay at pump start-up”, and where needed “PAL110 = Source-side flow switch - alarm delay at pump start-up”.

If your system does not fall in the examples below, please contact the manufacturer.

The installer must implement the system in compliance with the existing regulations at both national and local level.

The installer must check the correct min. flow rate to the heat exchangers of each unit under all operating conditions, both on the user side and on the source side when it comes to water/water units.

3.13.1 Multilogic: units with dedicated user-side pumps

On/off pumps Pu are mounted on every single unit and they operate at fixed speed although the system operates at variable flow rate as the number of active pumps is variable and depends on the thermal load (“PA1=2” on units connected to the Multilogic network).

The units may also be supplied with the option Flowzer VP (adjustable pump speed) because the pump in each unit operates at fixed speed as if it was an on/off pump. Pump speed calibration is quite important in this case for the pump to provide the correct flow rate in the worst case scenario, which needs to be identified on site based on the combinations between the units.

The units may also be supplied with the option Flowzer VDE (constant water flow control inverter pump) because the pump in each unit operates to keep constant the water flow rate through the heat exchanger fitted in the unit. The calibration of the min. pump speed is quite important in this case for the pump to always be able to provide the correct flow rate in the worst case scenario, which needs to be identified on site based on the combinations between units.

The diagram below shows the pump “outside the unit”: both configurations are possible - with pump installed onboard or outside the unit. In both cases, the pump **must** be controlled directly by the unit for the type of system specified.

EXAMPLE CH air/water unit

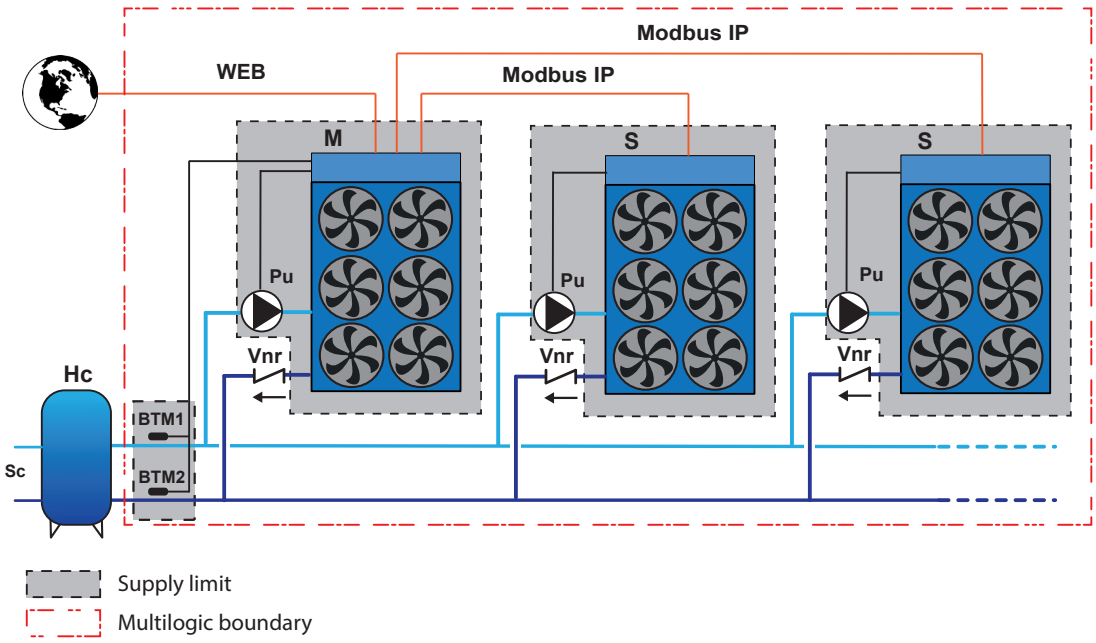


Fig. 8 CH air/water unit

EXAMPLE CH water/water unit

As regards the user side, there are no differences in terms of water pump control between this configuration and an air/water installation: the arrangements illustrated above must be followed. As for condensation control, each unit manages condensation control independently from the other units, which is why it is important that on the system/installer side the necessary water flow for worst case conditions is provided. The unit in operation performs the necessary setup independently from the other units and based on its configuration. The part of the system on the source side can be independent - not shared among the units. Other source-side configurations/controls are possible, but they have to be evaluated beforehand with the support of the unit manufacturer.

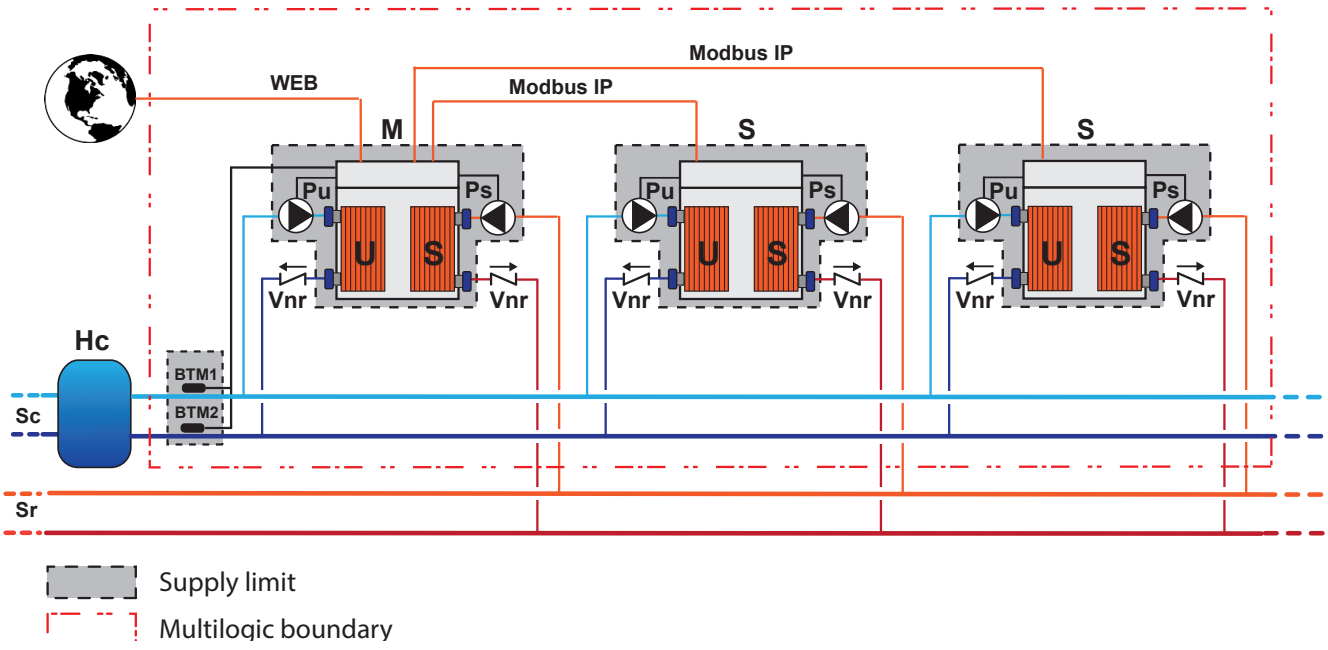


Fig. 9 CH water/water unit

3.13.2 Multilogic: unit with external centralized pumping system

The system consists of one single external pumping unit that controls the entire system (external option). The Multilogic function controls opening and closing of the water valves, where fitted and if their management has been requested. In any case, management of the flow rate (either variable or fixed) of the centralized pump falls under the responsibility of the client who shall guarantee the min. flow rate to the heat exchangers under all conditions.

EXAMPLE Air/water unit

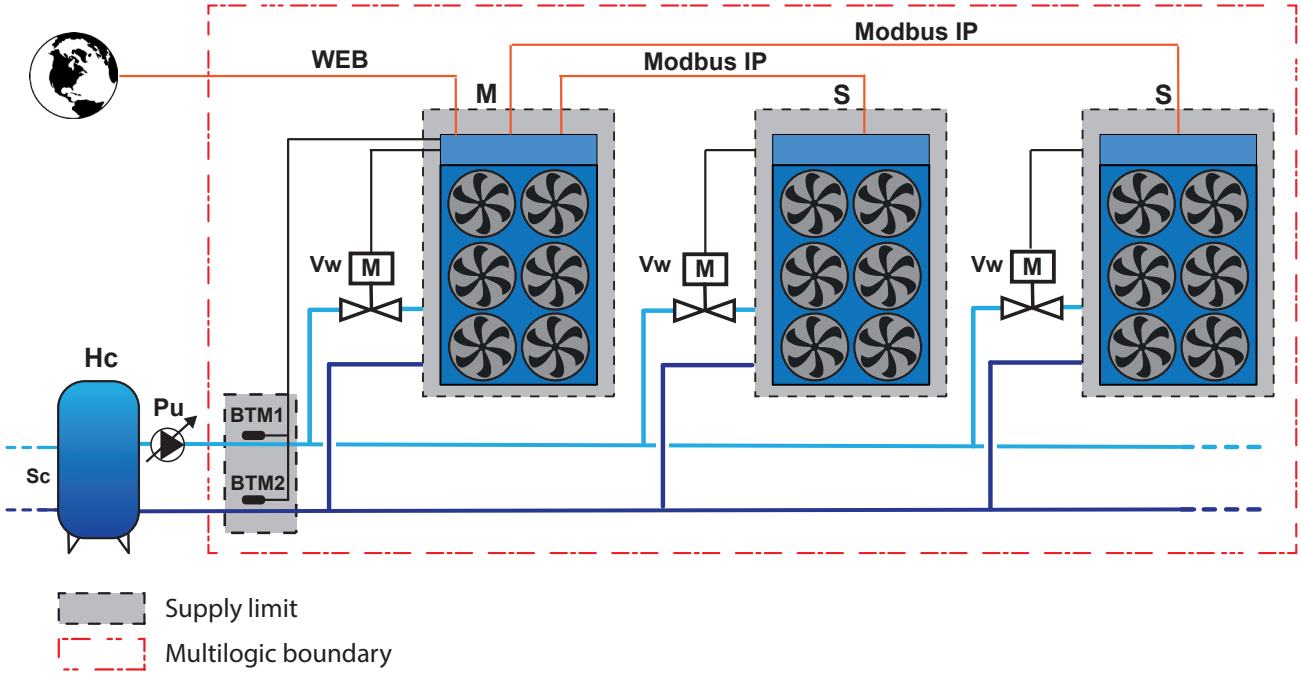


Fig. 10 CH air/water unit

EXAMPLE CH water/water unit

The same observations on the user and source sides expressed while commenting the diagrams above apply in this case too.

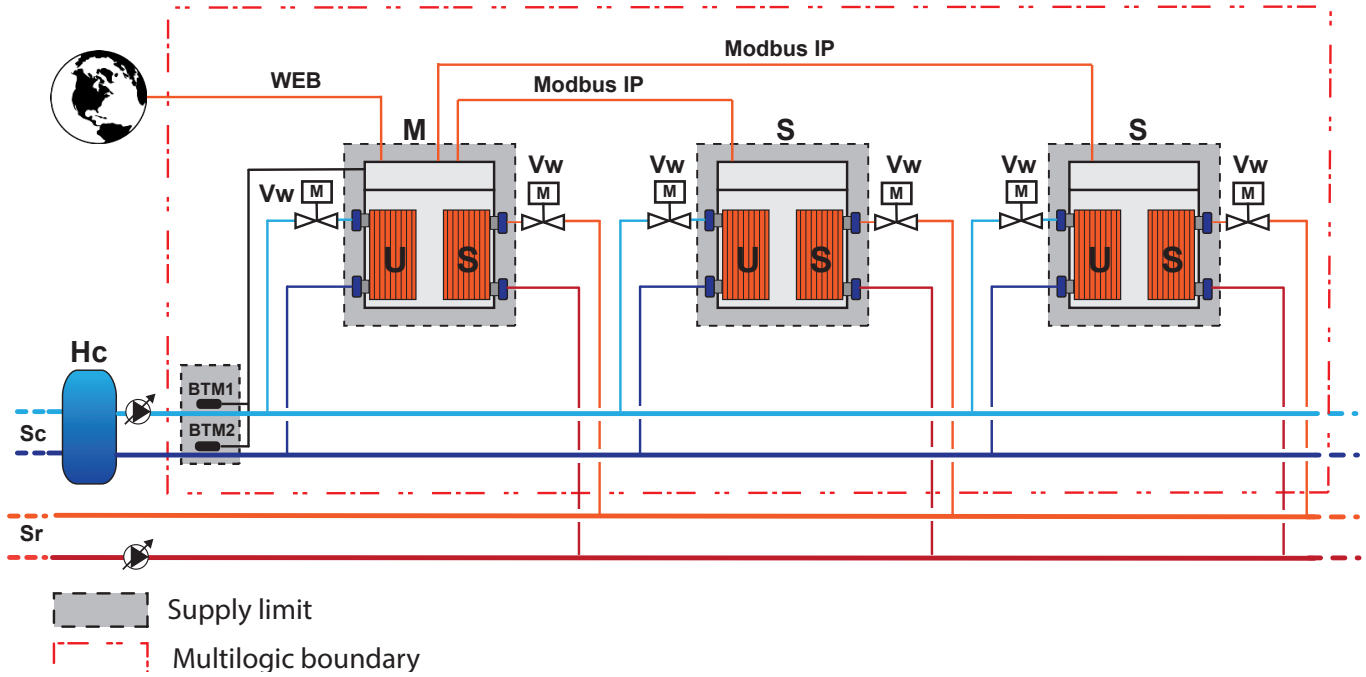


Fig. 11 CH water/water unit

3.13.3 Instructions for correct system operation

The installer should make sure that, but not limited to it:

- install a check valve at the user-side outlet of each unit to prevent water recirculation when the pump of the unit is not running; if the installation includes an external centralized pumping system, the check valves at the unit outlet **are not required**: recycling is avoided and the water valve is fully closed;
- the existing requirements for the check valves on the user side also apply to the part of the system on the source side in water/water units;
- sensors BTM1 and BTM2 of the Master unit needs to be correctly installed (in the common sections of the system); suitable pockets (correct length and diameter) are used for the featured probes so that each probe is correctly fitted “in the water flow” and an appropriate heat conducting paste is used to enhance the reading accuracy of the probe;
- the installer must ensure the correct min. flow rate to the heat exchangers of each unit is checked under all operating conditions, both on the user side and on the source side when it comes to water/water units;
- the external pumps or the water on/off valves for each individual unit are fitted;
- suitable water filters need to be installed in the system;
- the system needs to be implemented in compliance with good installation practices and **the existing regulations** (by way of exemplification, but not limited to it, through the installation of expansion joints, where required, air vents at the highest points of the system, safety valves, expansion vessels, etc.).

Although the system diagrams are functional diagrams, they show the correct locations of devices (probes, non-return valves, etc.) to the system.

3.14 Managing the defrosting function on Multilogic installations

Software versions 601.125.114 include new functions that improve defrosting on the air/water units in the heat pumps installed in Multilogic units.

These functions are included in the standard software and are activated in the factory.

The functions are as follows:

- average outdoor air temperature reading;
- redistribution of thermal demand;
- management of simultaneous defrosting cycles.

The parameters concerned are illustrated below.

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

Master and Slave

Parameter	Value	UM	Description
DF1	2	--	Defrost method 0 = Disabled 1 - Fixed evaporation temperature 2 - Variable evaporation temperature
DF10	-12.0	°C	Fixed evaporating threshold to start defrost
DF11	180	Sec.	Defrost start delay
DF42	-50	°C	Smart Defrost Multilogic – Advance defrost band
DF43	180	Sec.	Smart Defrost Multilogic – Persistence interval in advance defrost band
DF44	120	Sec.	Smart Defrost Multilogic – Minimum time between defrosting different machines
SP22	0	--	Enabling new multilogic features 0 = No 1 = Yes

3.14.1 Average outdoor air temperature reading

The function is enabled with the value of the parameter "SP22" = "1"

The Master collects the readings from the outdoor air sensors connected to the various operational Multilogic system units, calculates the average value, and sends it back to the units.

In this way, all the units use the same outdoor air temperature value.

For example, all the units use the same value to calculate the moving defrost threshold.

3.14.2 Redistribution of thermal demand

The function is enabled with the value of the parameter "SP22" = "1"

This function permits the master to redistribute the thermal capacity to the other available units.

When a unit enters defrost mode, the Master redistributes its portion of the demand between the other units that are still operating in heat pump mode, optimising the behaviour of the system and improving the stability of the temperature control function.

This function may be rendered more efficient if the Multilogic system also includes redundant units.

3.14.3 Management of simultaneous defrosting cycles

The function is enabled with the value of the parameter "SP22" = "1"

This function limits the possibility of two or more units connected in the same Multilogic system entering defrost mode simultaneously. In this way, it is possible to avoid over-rating the water inertia and accumulation, while improving system regulation.

The parameter DF1 may be used to defined whether the defrost threshold is fixed (at the value set-up in parameter DF10) or variable (calculated using the air temperature value). Multilogic systems use the average air temperature value calculated by the master, as described above.

The value set-up for parameter DF42 on each operational unit defines the interval by which the defrost request is anticipated with respect to the threshold obtained with the value set-up for parameter DF1.

Anticipate defrost threshold = threshold obtained with the value set-up for parameter DF1 + value set-up for the parameter DF42.

It is important to ensure that the DF42v is set to the correct value so as to optimise the reduction of simultaneous defrosting.

The correct value for the parameter DF42 must be positive and less than 2°C; On the units, the default value of the parameter is -50°C. In this case, the parameter does not have any effect on the management of the defrosting cycles.

If parameter DF42 is set to a value higher than 1°C it could generate lists that are too long to be managed correctly.

In order to establish the correct value for this function, we recommend setting parameter DF42 to 1°C, and then making small adjustments over time.

The operating unit sends the defrost request to the Master when the anticipate defrost threshold is reached for a period exceeding the value set-up for parameter DF43.

The Master creates a list of all the units that have generated defrost requests and grants them one at a time, in the order they were received.

Each unit manages the defrosting cycle autonomously, in accordance with the duration, start and end of the process, as defined by its parameter settings.

Once a unit has finished defrosting, the Master grants the subsequent defrost request on the list, once the period defined by parameter DF44 has elapsed.

While awaiting their turn to defrost, all the other units on the list continue to operate in heat pump mode.

Thus, the list is updated in real time each time one of the units finishes defrosting and each time another unit reaches the anticipate defrost threshold.

There are certain exceptional circumstances under which the list may not be respected:

- if a unit reaches the defrost condition defined by the parameter DF1 for a period exceeding the value set-up for parameter DF11, while it is waiting for the Master to grant it permission to defrost, it initiates a defrost cycle, irrespective of the operating status of the other units or whether it has received permission from the Master, and is eliminated from the waiting list.
- If a unit reaches the defrost conditions for a limited period or due to low outdoor temperature, it initiates a defrost cycle, irrespective of whether it has received permission from the Master.

The Master screen, which provides a summary of the Multilogic system status, indicates the status of the various units and which ones are in defrost.

3.15 Multilogic: description of display pages

All information regarding the Multilogic function is given in specific pages.

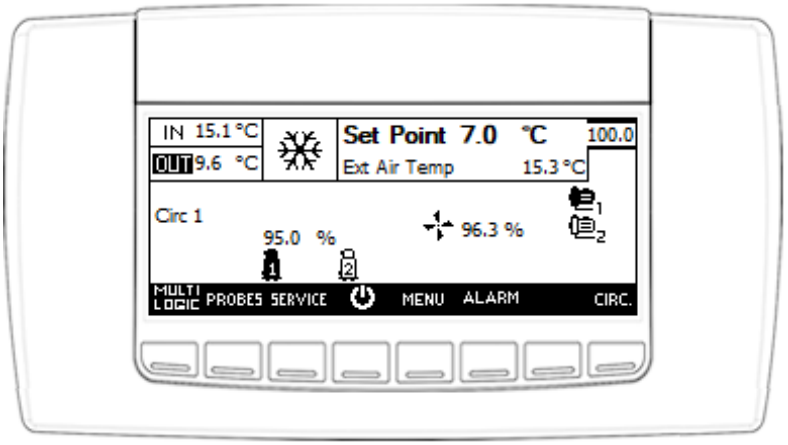


Fig. 12 Main controller screen

With Multilogtic, the temperatures and the setpoint of the main screen correspond to:

- readings of the Multilogic system and setpoint probes if the Master is online;
- local probe readings and local setpoint if the Master is offline;
- local probe readings and local setpoint if the unit is a Slave.

A click on the “Multilogic” button on the main page gives access to the screens dedicated to this function.

3.15.1 Master unit pages

When the Master unit is selected, a click on the “Multilogic” button shows information on the Master unit as well as system information.

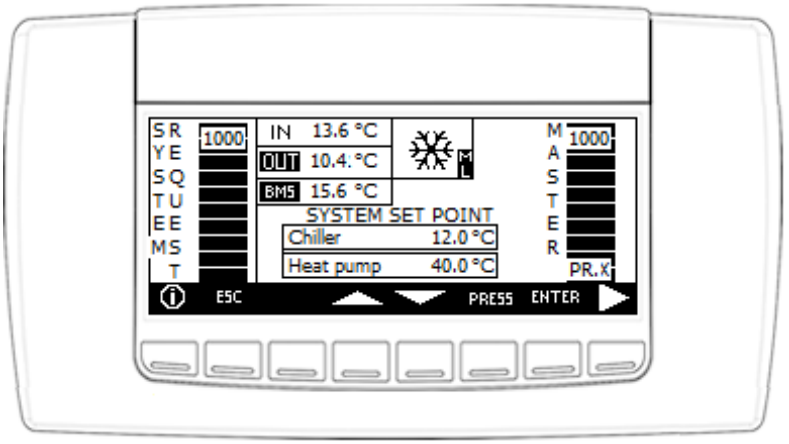


Fig. 13 Main screen of the Master regarding the Multilogic function

The left hand side of the page shows the total capacity demand of the system, which ranges from “0 = no capacity demand” to “1000 = total capacity delivered by Multilogic system”.

The right hand side of the page shows the priority level of and the percentage capacity requested from the Master unit which ranges from “0 = no capacity demand from Master” to “1000 = max. capacity demand from Master”. The latter is a percentage of the max. capacity of the Multilogic system that depends on the number of units featured.

If the system is fitted with two units, both units are in operation, and the system demands all the available capacity, the following values will appear on screen:

- System request = 1000;
- Master = 1000;
- Slave = 1000 (as explained later on).

The values that appear in the centre of the screen at the top of the display represent the water temperatures measured by the common installation return line (IN) and delivery line (OUT) probes (probes BTM1 and BTM2 on the preceding diagrams), the operating state and the presence of any alarms (indicated by the “alarm” symbol).

The text "**ML**" steady, indicates that the units are online, if "**ML**" is flashing, at least one unit is offline and AL16 appears.

The term “**OUT**” indicates that the Multilogic function reads the water temperature on the probe fitted on the common system delivery line.

The bottom central part displays the setpoint values of the system regarding the operating mode. The setpoint values can be changed using the “arrow up” and “arrow down” buttons. After changing a value, it must be confirmed pressing the “Enter” button.

A click on the “Esc” button gives access to the main screen.

Press the “RH arrow” key to access the screen displaying all the present in the case of group installations.

The following image shows 4 groups making up an installation consisting of 32 units.

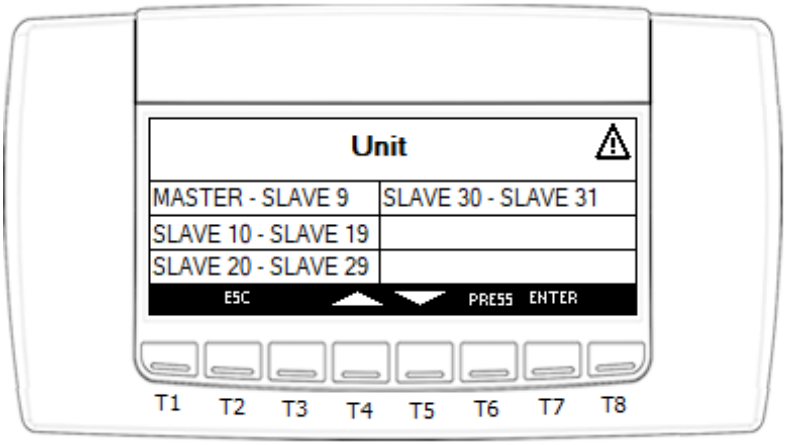


Fig. 14 Master Screen displaying all the units present in the installation

Use the arrow keys to select one of the groups of units and press “Enter” to view the main operating parameters.

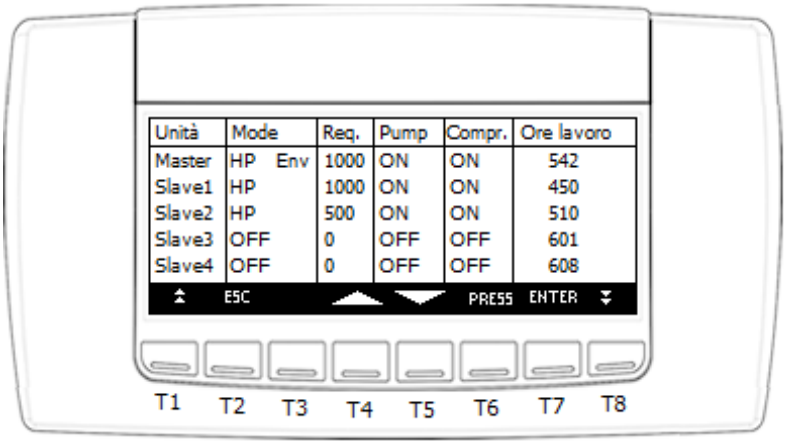


Fig. 15 Selected unit screen

The main operating parameters displayed on the screen are:

- unit name;
- the operating mode (OFF, CH, HP or ACS) and, in configurations that include the option of maintaining at least one compressor inside the envelope active, and the function is enabled, the message “Env”;
- request, expressed in thousandths of the unit;
- status of the pumps (OFF, ON, Disabled);
- status of the compressors (Off or ON);
- unit working hours.

Use the arrow keys to select one of the units in the group and press Enter to conform and access screen where the information relating to the function are displayed.

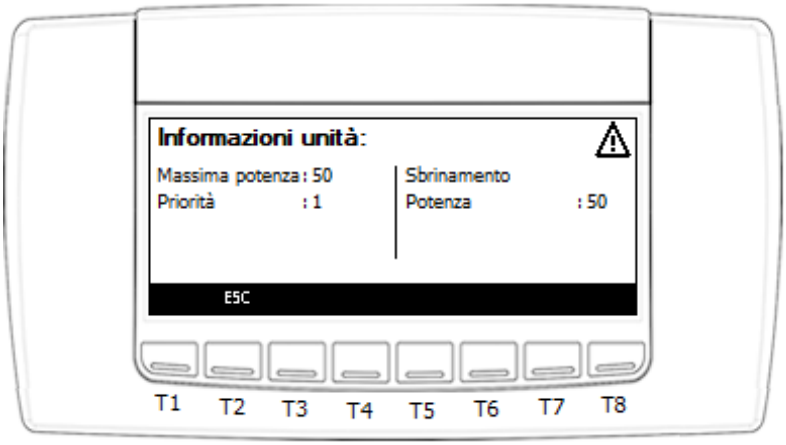


Fig. 16 Selected unit screen

The following values are displayed on the unit information screen:

- maximum power delivered by the unit, expressed as a percentage;
- priority;
- defrosting power (if the unit is in heat pump mode).

3.15.2 Pages of the Slave units

When a Slave unit is selected, a click on the “Multilogic” button gives access to the pages of the Multilogic function. In the Slave units, there is just one page for viewing information regarding the slave unit.

The left side of the page shows the mechanical capacity required from the Slave unit by the Master and the priority of the Slave unit.

The top area shows:

- the water temperature at the inlet and outlet of the system if the Slave unit is online (IN and OUT);
- the water temperature at the inlet and outlet of the unit if the Slave unit is offline;
- the term “**OUT**”, which indicates that the function reads the water temperature on the probe fitted on the delivery line;
- the wording “SLAVE UNIT OFF-LINE” with the “alarm” symbol, which indicates that communication with the Master is missing.

A click on the “Esc” button gives access to the main screen.

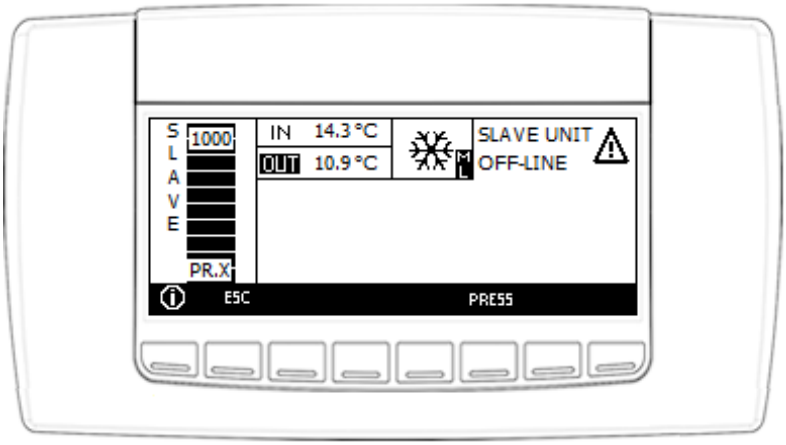


Fig. 17 Screen of the Slave units regarding the Multilogic function

3.16 Multilogic: alarms

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.

AL15	**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

AL16	**Communication error between units**
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.

AL149	**Inlet water temperature probe error (system)**
AL150	**Outlet water temperature probe error (system)**
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

ACF13	**Multilogic network configuration alarm**
Reason for activation	It is displayed in the Master when the priority level is not assigned correctly to the networked units.
Reset	When the priority level is assigned correctly to the units of the network
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Maintains the "OFF" state that should have been set before modifying the "MS" parameters
The other devices	They follow their control

4 MULTILOGIC WITH FREECOOLING UNIT: MULTI-FREE

4.1 Principle of operation of the Multifree function

The Multifree function is designed to control chiller units with freecooling. When the necessary conditions exist, this function is designed to use freecooling, as featured in all the networked units, before starting the compressors.

The Master unit actually enables the Multifree function on detecting freecooling conditions.

When the conditions for freecooling do not exist, the system is controlled in the same way as with the Multilogic function.

The Multifree function is only available for units that are connected using the Multilogic function and have the freecooling function either installed or enabled.

4.2 Multifree: alternatives and constraints

The same alternatives and limitations as a Multilogic network apply plus:

- **the Master unit must be supplied with the freecooling function; the system can be fitted with CH Slave units without freecooling;**
- **no heat pump units can be fitted;**
- **mixed connections between air/water freecooling units and water/water no glycol freecooling units must not be made.**

4.3 MS_FC – Multifree parameters

All setup parameters of the Multilogic function have already been listed and described in the previous sections and must be set consistently with the requirements of the Multilogic management function. The main parameters that need to be set for the Multifree management function are listed in the table below together with a basic explanation so that the user can understand the meaning of each parameter. An additional column specifies whether the parameter needs to be edited/monitored on all units, on the Master unit only or on the Slave units only. This should help the user more easily understand the settings described below. Please note that **the most frequently used parameters** are described in depth in the following sections.

If the freecooling units are networked in the Multilogic system, correct operation of the Multifree function requires that each unit is left ON and the freecooling function enabled. The Master unit controls which units will receive capacity and thus be operational and which ones will not (in other words, which units will operate in freecooling mode only or even with the compressors ON, and which ones will have the compressors and pumps OFF, an so on).

When the “MS_FC” parameters are changed, the unit must be in the “OFF” state. If it is not, restarting of the controller may occur.

4.3.1 MS_FC – Multifree parameters - preset parameters

Change to be made in	Parameter	Description / Additional notes
Master	MS_FC3	*Multifree capacity distribution mode*
		0 = Balanced
		1 = Saturation
		“MS_FC3” indicates the capacity distribution mode when the Multifree function is enabled among the various units that are connected to the Multilogic network, with the freecooling option active.
Master	MS_FC4	*Number of backup units*
		Range: 0 .. MS_ FC5
		“MS_FC4” is used to set the number of freecooling units in backup.
Master	MS_FC5	*Number of units involved (including Master)*
		Range: 2 .. MS2.
		“MS_FC5” is used to set the total number of units connected to the Multilogic network that can be involved in the Multifree management function. This basically identifies the number of units that can run in freecooling.
Master	MS_FC7	*Temperature differential required for freecooling activation*
		Range: - 50,0 .. 110,0 °C
		“MS_FC7” is used to define the min. difference between the water temperature in the system return line and the temperature of the outside air required to enable the Multifree function. Both probes are connected to the Master unit.
Master	MS_FC8	*Hysteresis for freecooling switch-off*
		Range: 0,1 .. 25,5 °C
		“MS_FC8” is used to set the hysteresis over the difference between the water temperature in the system return line and the temperature of the outside air required to disable the Multifree function after it has been enabled against “MS_FC7”.
Master	MS_FC19	*Delay in ventilation step de-activation under the neutral zone (falling time)*
		Range: 0 .. 999 s.
		These delays in the de-activation of the ventilation steps trigger during the calculation of the freecooling capacity of the Master when the system outlet temperature is below the setpoint.
Master	MS_FC20	*Delay in ventilation step activation under the neutral zone (raising time)*
		Range: 0 .. 999 s.
		These delays in the activation of the ventilation steps trigger during the calculation of the freecooling capacity of the Master when the system outlet temperature is higher than the setpoint plus the neutral zone.
Master	MS_FC23	*Compressor activation delay after reaching full freecooling capacity*
		Range: 0 .. 999 s
		As soon as the percentage capacity the Multifree function can deliver within the activation zone is 100%, the Multilogic – Multifree system waits for as long as the delay set in MS_FC23 before increasing the capacity required for compressor management.

4.3.2 MS_FC – Multifree parameters - additional parameters

The parameters listed below are part of the MS_FC – Multifree parameter group. These parameters are generally set by the manufacturer during the FAT process, based on the configuration, number and type of units contemplated in the order. Inn other words, they do not normally require editing even if they are at “service” level. The manufacturer also defines the step for increasing and reducing the demand.

Change to be made in	Parameter	Description / Additional notes
Master	MS_FC1	*Enable Multifree, Freecooling*
		0 – Not used
		1 – For water/water, no glycol unit
		2 – Internal freecooling
		This is a manufacturer’s parameter in Service view mode: it is set up in the factory, based on the type of freecooling units connected to the Multilogic network.
Master	MS_FC2	*Multifree de-activation differential*
		Range: 0,1 .. 25,5 °C.
		This parameter identifies the Multifree de-activation differential: when the common outlet water temperature is below the “MS49-MS_FC2” setpoint, the Multifree is disabled.
Master	MS_FC9	*Minimum freecooling fan speed*
		Range 0 .. 100%.
		MS_FC9 is used to set the min. speed of the “virtual” Multifree fan when freecooling is possible.
Master	MS_FC10	*Maximum freecooling fan speed*
		Range 0 .. 100%.
		MS_FC10 is used to set the max. speed of the “virtual” Multifree fan when freecooling is possible.
Master	MS_FC11	*Speed-up time of freecooling fans*
		Range: 0 .. 999 s.
		This parameter is used to set the operating time of the fans at max. speed when the fans are switched on.
Master	MS_FC17	*Max. outside air temp. limit required for freecooling de-activation*
		Range: -50 .. +110 °C.
		This is the value of the outside temperature beyond which the Master does not consider it possible to run freecooling and to activate the Multifree function.
Master	MS_FC18	*Min. outside air temp. limit required for compressor de-activation*
		Range: -50 .. +110 °C.
		This is the value of the outside temperature below which the compressors are disabled as the freecooling capacity - and the Multifree function capacity, as a consequence - is enough to cover the required cooling capacity.
Master	MS_FC21	*Increase percentage of freecooling steps with neutral zone (0..100%)*
		Range: 0 .. 100%
		This parameter is used to calculate the increase in the freecooling capacity because the Multifree function is active. Although this is a Service parameter, it is set up by the manufacturer and it is normally **not modified**.
Master	MS_FC22	*Vent. activation differential (only with proportional control)*
		Range: 0.1 – 25.5 °C
		This parameter is used when proportional control is enabled, which is not possible with the Multifree function.
Master	MS_FC25	*Multifree activation differential*
		Range: -50,0 .. +110,00 °C
		This parameter defines the differential temperature below the setpoint which causes the water valve to open at 100% when air/water freecooling units are installed.

4.3.3 FC – Freecooling parameters

These parameters are used for freecooling management of the standalone unit. Some of them are also used in the Multifree version with water/water freecooling units to manage the dry cooler, pump and 3-way valve.

4.4 Multifree: implementation of MASTER/SLAVE communication network

The procedures to add units to an Ethernet network are described in section “Multilogic: implementation of MASTER/SLAVE communication network” of the Multilogic function, including the setup limits already illustrated in the previous sections.

4.5 Multifree: priority

The Freecooling priority is the same as set in the unit with the Multilogic parameters.

The priority of all units equipped with freecooling must be set to “1”.

4.6 Multifree: main Master parameters and capacity management

After correctly setting the parameters of group “MS” concerning the Multilogic function, the parameters of group “MS_FC” must be set/edited in the network Master unit to define the Multifree function.

When the “MS_FC” parameters are changed, the “Master” unit must be in the “OFF” state. If it is not, restarting of the controller may occur.

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

Master

Parameter	Value	UM	Description
MS_FC3	0	-	Multifree capacity distribution mode (0 = Balanced; 1 = Saturation)
MS_FC4	0	-	Number of backup units
MS_FC5	2	-	Number of units involved (including Master)

When setting these parameters, please keep in mind that parameter “MS_FC3” is used to set the capacity distribution of the freecooling function, which may be different from the capacity distribution of compressors set in parameter “MS6”.

The capacity distribution modes for the Multifree management function include:

- “Balanced” - freecooling of all the units is progressively activated as the demand increases. In this case, the freecooling function is activated with a delay that is controlled by the algorithm of the controller;
- “Saturation” - the freecooling of one unit is made to rise to 100% before starting activation of the next unit. The criterion by which a freecooling unit is selected to switch on or to switch off is based on the number of hours of operation of the pumps.

If parameter “MS-FC4” is set to have freecooling units operating in backup mode, but the freecooling of the available units fails to meet the capacity demand, the compressors are activated **and not the backup freecooling units**. The backup units only become operational during unit rotation or in presence of an alarm. Unit rotation will always take place based on the number of hours of operation of the pumps, following the same criteria that are set up for rotation in Multilogic mode (rotation by hours of operation or at fixed intervals).

4.7 Multifree: thermoregulation

Before examining in detail the conditions required for Multifree mode activation in the possible cases, it is worth dwelling on the procedure that the Master uses to calculate the percentage freecooling and mechanical cooling during temperature control, provided that the freecooling conditions are valid.

The algorithm of the Master controller for thermoregulation of the Multifree function is designed to adjust the capacity delivered by the units to the system demand, prioritising freecooling activation.

The activation of the freecooling function in units that are supplied with it always takes place before compressor activation.

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
MS49	7.0	°C	Setpoint
MS67	1.5	°C	Neutral zone
MS55	5.0	°C	With NZ or PID, activation area offset in chiller mode
MS57	2.0	°C	With NZ or PID, de-activation area offset in chiller mode
MS_FC19	10	s	Stepped fan deactivation delay
MS_FC20	10	s	Stepped fan activation delay
MS_FC23	60	s	Compressor activation delay after reaching full freecooling capacity

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

- Tout = outlet water temperature from the system. This is the temperature probe on the common delivery line that is connected to the Master: it is identified as BTM2 in the system diagrams illustrated below.
- Power_UP = zone within which the cooling capacity is activated/increased
- Power_UP_Freecooling = increase in mechanical cooling capacity upon freecooling activation
- Power_UP_Compressor = increase in mechanical cooling capacity upon compressor activation
- NZ = neutral zone
- Power_DoWn = zone within which the cooling capacity is de-activated/reduced
- Power_DoWn_Compressor = decrease in capacity upon compressor de-activation
- Power_DoWn_Freecooling = decrease in capacity upon freecooling de-activation

For correct operation of the system, set point "ST1" of all the units and system set point "MS49" must correspond.

Parameters MS49, MS50, MS51, MS52, MS53 and MS54 must always be aligned with parameters ST1, ST2, ST3, ST4, ST5 and ST6.

Moreover, to have a good behavior of the plant in offline condition, it is advisable to set in standalone mode the Neutral Zone and PID control based on the outlet temperature probe for each unit.

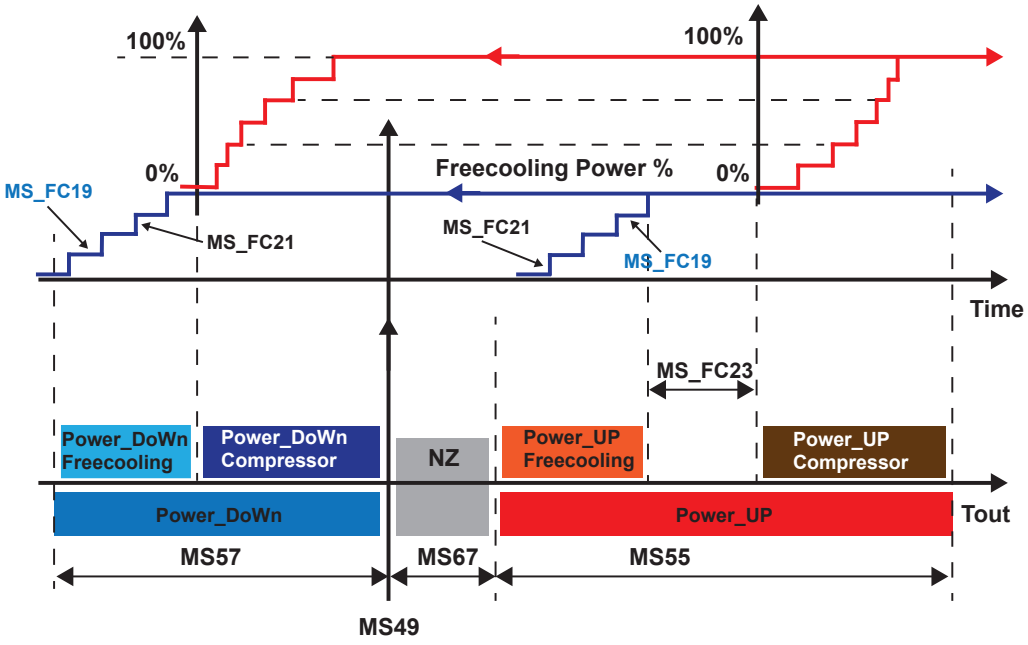


Fig. 18 Thermoregulation management

Thermoregulation is based on the control of the outlet water temperature “T_out” measured by the common probe connected to the Master that measures the outlet water to the system.

- when “Tout” is in the neutral zone (“NZ”), the thermoregulation system calculates an increase in capacity only on condition that the demand already exceeds 0%, otherwise the increase will be 0%;
- When the water temperature is higher than the setpoint plus the neutral zone, the Master calculates the percentage freecooling capacity **first**. The Master increases the freecooling capacity by one step, as specified in “MS_FC21”, at every interval of time set in “MS_FC20”. The Master then distributes the freecooling capacity, as calculated above, among the available units in compliance with the “Balanced” or “Saturation” logic illustrated above.
- As soon as the percentage freecooling capacity has achieved 100%, the system will wait for a standby time, as set in “MS_FC23”, after which the Master starts calculating and sharing the percentage mechanical freecooling capacity according to the logic described for the Multilogic function, if the “Tout” value is still within the activation zone.
- As the capacity demand increases, the “Tout” value starts being reduced. If the temperature goes back to the neutral zone to such extent that the required capacity exceeds 0%, the Master continues to increase the required capacity with a very slow increase time, which is set by the manufacturer.
- As soon as “Tout” is smaller than the setpoint, the Master firstly starts reducing the mechanical capacity, as already explained for the Multilogic function, and then the freecooling capacity by way of a one-step reduction, as specified by parameter MS_FC21, at every interval of time defined by “MS_FC19”.
- If the min. capacity provided by the Multilogic system is greater than the thermal load, the case may be that the setpoint is met and both the freecooling capacity and the mechanical capacity are zero.

4.8 Multifree: activation conditions

As is the case for standalone unit operation, in Multilogic configuration too activation conditions must be met for the system to operate in freecooling mode.

The parameters involved for preparation of the function are shown in the table.

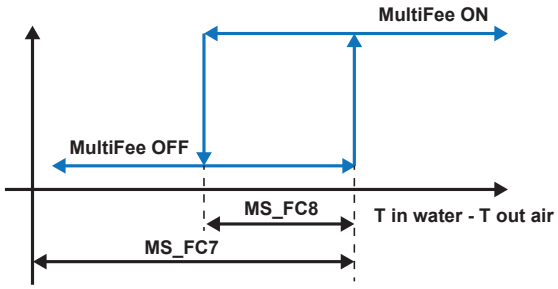
The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
MS_FC7	5.0	°C	Temperature differential required for freecooling activation
MS_FC8	2.0	°C	Hysteresis for freecooling switch-off

The conditions required for the activation of the Multifree function include:

- the Master unit must be ON;
- **the Multifree function must be enabled from the pages of the Master and Slave units using the keyboard;**
- the air temperature must be lower than the value set in parameter “MS_FC17”;
- the condition concerning the difference between the temperature of the common water return line and the temperature of the outside air must be met (BTM1 – BT3 as respectively identified in the diagrams below);
- in the Master, alarms AL83, A149 and AL150 must not be active.

A graphical representation is shown below.



The Multifree function is stopped if one of the following alarms is experienced in the Master unit: “AL83 = Ambient air temperature probe error”, “AL149 = System inlet temperature” or “AL150 = System outlet temperature”. Even if they are connected via a serial line, the Slave units work in standalone mode.

4.8.1 Multifree: air/water units

When the Multifree function operates under the conditions described above, the Master unit sends each individual unit the fan speed, as calculated according to the freecooling percentage for each unit, based on the capacity management value set in parameter “MS_FC3”, and the opening percentage value of the 3-way water valve.

4.8.1.1 Valve activation

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

Master

Parameter	Value	UM	Description
MS49	7.0	°C	Setpoint
MS67	1.5	°C	Neutral zone
MS_FC2	4.0	°C	Multifree de-activation differential
MS_FC25	0.5	°C	Multifree activation differential

With the Multifree function active, the valve operates as follows:

- it opens 100% when the reference water temperature is higher than the setpoint in parameter “MS49” plus the dead zone (“MS67”);
- during regulation it is fully open when the reference temperature is higher than “MS49 - MS_F25”;
- fully closed when the reference temperature is lower than (MS49 - MS_FC2)
- when the reference water temperature is between “MS49 - MS_FC2” and “MS49 - MS_FC25”, its opening will be proportional to the temperature value if a modulating valve is fitted, whereas its status will depend on its source condition if an on-off valve is fitted;
- in No Glycol versions management using the freecooling pump is an alternative to using the valve (plus flow control and thermal overload protection of the pump).

The regulation is based on the monitoring of the water temperature at the outlet of the system (“Tout”), as shown in the graph.

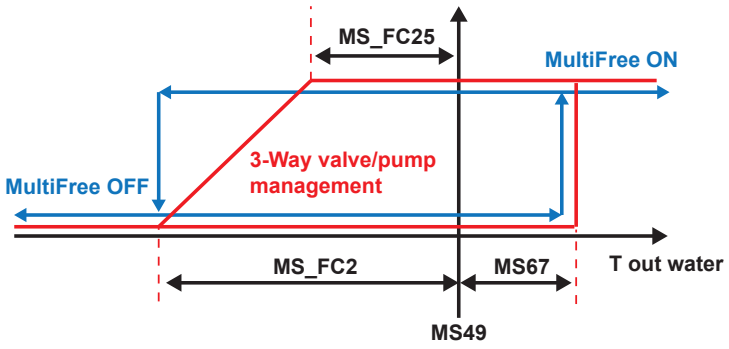


Fig. 19 Freecooling valve/pump control in air/water units

4.8.1.2 Ventilation activation

The Master calculates the freecooling fan speed of each unit, based on the percentage freecooling capacity distributed to each unit and against the min. and max. parameters specified below. The units individually then manage the activation of the fans via an analogue signal or steps with digital outputs, according to their configuration.

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
MS_FC9	30	%	Min. speed of freecooling fans
MS_FC10	100	%	Max. speed of freecooling fans
MS_FC11	3	s	Speed-up time of freecooling fans

For easier starting of the fans, the signal is overridden to the maximum value at start-up for the time set in parameter MS_FC11. Please find below a graph showing three units, of which one Master unit and two Slave units, without freecooling units in backup.

In "Balanced" mode, activation of the fans takes place with a delay "Dt" managed by the algorithm of the controller.

When freecooling is not enough, the Master unit also outputs an ON signal to the compressors, as calculated for the Multilogic system. Each unit switches to combined operation as soon as they receive the mechanical cooling % from the Master unit.

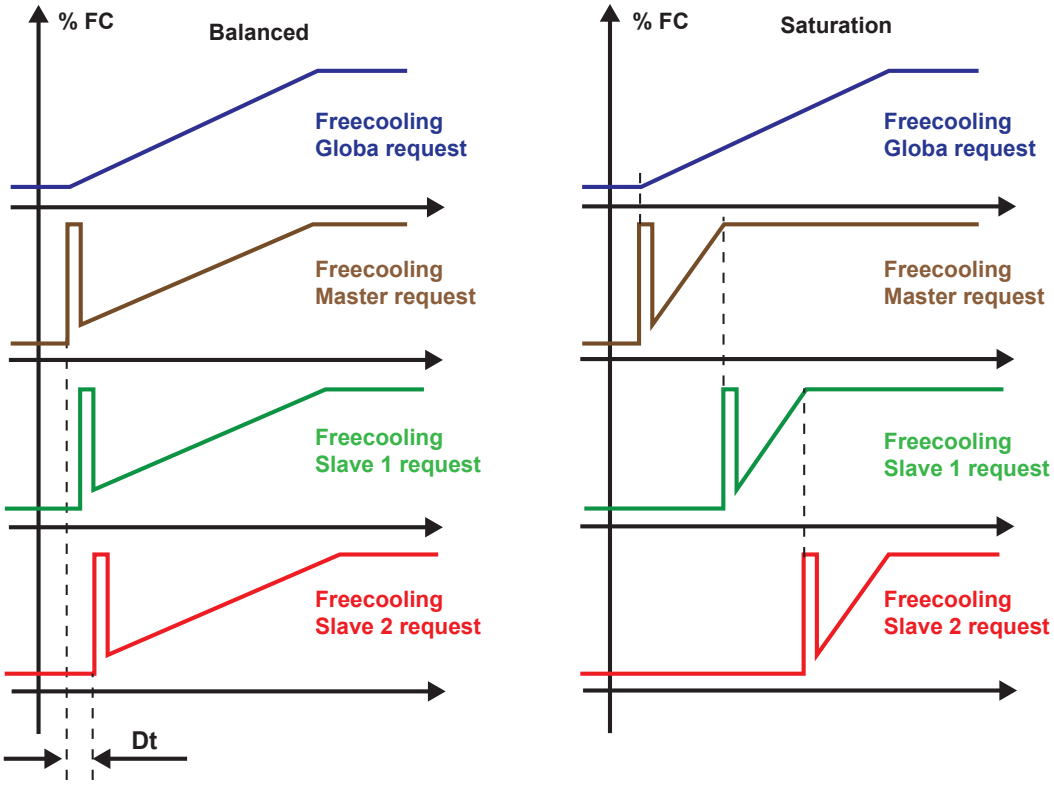


Fig. 20 Activation of fans in Balanced and Saturation mode

4.8.1.3 Stepped ventilation

Where ventilation is stepped (without speed controller), it includes two to four steps.

The freecooling demand received by the Master unit is split into the existing number of steps by the controller of each unit.

The step activation sequence reflects the capacity demand received, according to the capacity management mode set in parameter “MS_FC3”.

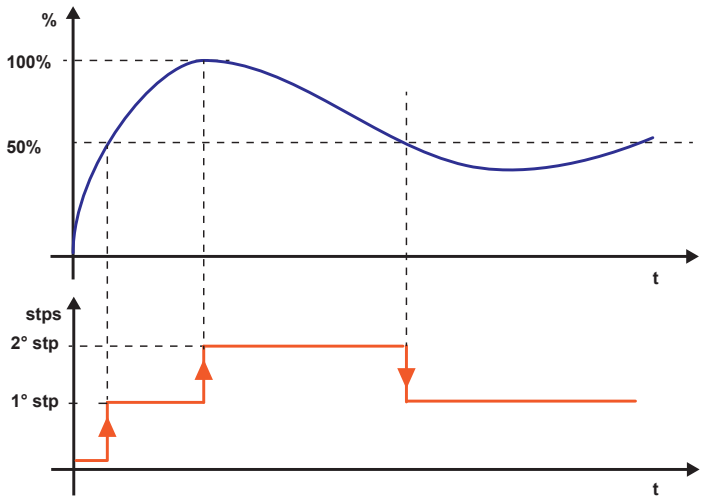


Fig. 21 Transformation of freecooling ventilation demand into two steps

4.8.2 Multifree: water/water, no glycol units

When the Multifree function is enabled under the conditions described above, the Master unit calculates the freecooling capacity to be shared according to the capacity management mode set in parameter “MS_FC3”; units activated in freecooling mode, on the other hand, manage the received percentage capacity following local control procedures.

Please find the operating sequence below:

- the Master unit starts calculating the freecooling percentage in Multifree mode and then sends the calculated value to the involved units together with the OK signal to the dry cooler pump. When the units connected in Multifree are water/water freecooling no glycol units, the percentage of freecooling in Multifree will be calculated as shown in the graph below. The Master then will distribute the percentage of Freecooling in Multifree in according to the setting of the parameter MS_FC3.

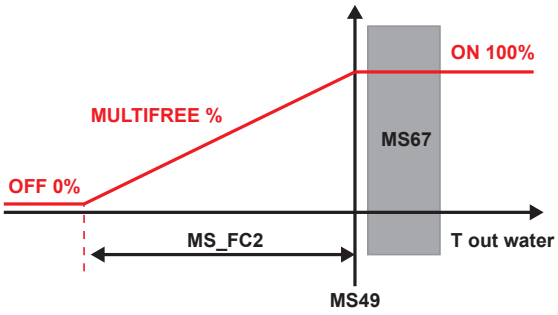


Fig. 22 Multifree freecooling percentage with water/water no glyco units

each unit manages the freecooling percentage value it receives “locally” and checks the values detected by its probes as well as the local activation conditions, after which it calculates the signal of the dry cooler fans, the pump speed, the position of the 3-way valve in freecooling mode.

- when the plant outlet water temperature exeeds the value "MS49+MS67", the Master waits for a delay time of "MS_FC23 + (100 / MS_FC21) * MS_FC20" and then it starts to calcolate the percentage of mechanical cooling and it outputs an ON signal to the compressors, as calculated for the Multilogic system. Each unit switches to combined operation as soon as they receive the mechanical cooling % from the Master unit and they manage the water valve in condensation control mode.

A typical example of combined operation is as follows: the temperature of the outside air is lower than the antifreeze threshold on the user side (“PAL36”) of each unit, which causes water from the dry cooler to be too cold, thus risking to damage the heat exchanger. In this case the system manages the compressors even if, as explained below, the setpoint of the dry cooler is lower. The cycle can, however, be resumed in combined mode with warmer water thanks to the contribution given by condensation.

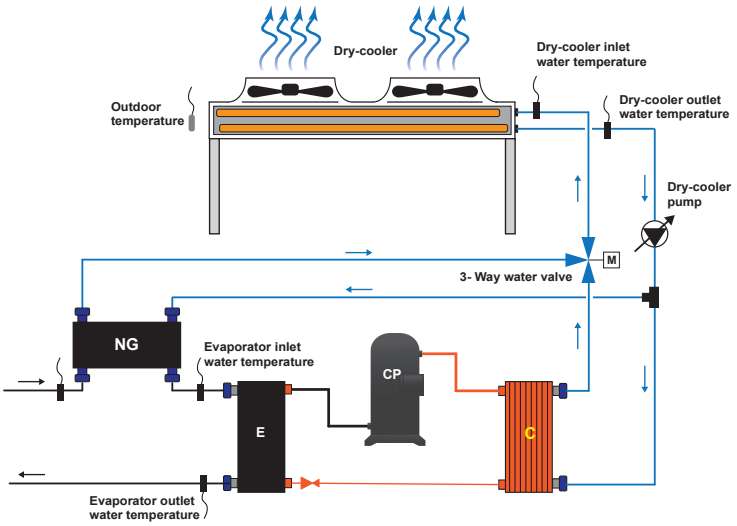


Fig. 23 Diagram illustrating a freecooling water/water, no glycol unit

4.8.2.1 Dry cooler management

The setpoint of the dry cooler signal in units activated in freecooling mode switches from the condensation control value ("FC29") to the calculated value ("ST1-FC30") and the signal each unit outputs is set by the corresponding input water probes on the dry-cooler/source side.

Systems in which the dry coolers are hydraulically interconnected in hydraulic parallel or sytems provided with one single dry cooler have the fans operating with one single signal. Correct management of the condensation temperature and the local freecooling conditions requires that the **installer provides for an external controller capable of reading the greatest analogue signal (0-10V)** of each unit and sending it to the dry cooler unit.

For correct system operation, setpoint "ST1" of all the units and system setpoint "MS49" must match.

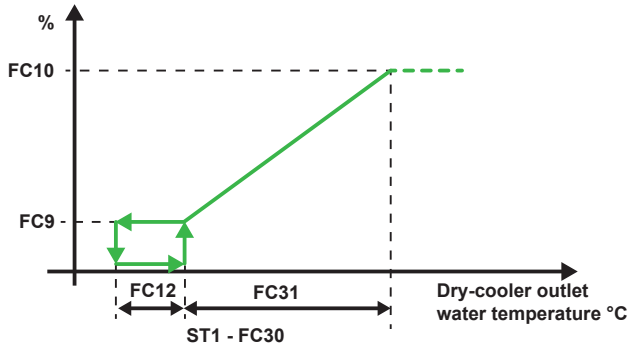


Fig. 24 Diagram illustrating how to set the speed of the dry cooler fans in freecooling mode

NOTE: proportional speed control of the dry cooler fans in freecooling mode actually works according to a PI control whose integral component is given by parameter FC28. Achievement of 100% dry cooler fan speed implies reaching the max. capacity deliverable in freecooling mode, as a consequence of which the unit waits for the delay time stored in "FC23" before switching the compressors ON, provided that the system has output a demand for mechanical cooling capacity as well.

4.8.2.2 Valve and pump management

The 3-way valve is controlled by each individual unit according to the operating conditions in which the unit is set.

If the unit is set for Multilogic management only, the 3-way valve is in "freecooling off" position and water is only used for condensation control, which is managed locally by the pump and the dry cooler, as explained in the relevant sections of the individual manuals.

If the unit is set for Multilogic operation under Multifree management, two possible options apply:

- **Freecooling only**. The pump works between its maximum and its minimum indicated in the FC - Freecooling parameters and follows the percentage of Freecooling received by the master according to the graph below. When the dry-cooler pump is ON, the 3-way water valve is 100% open in freecooling and it circulates the water between the dry cooler and the decoupling exchanger. When the dry-cooler pump is OFF, the 3-ways valve is in OFF Freecooling.

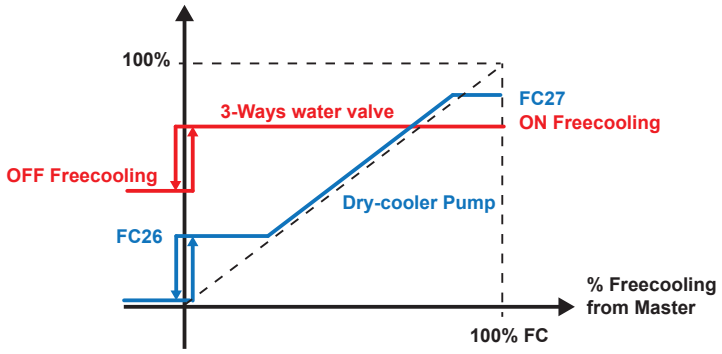


Fig. 25 Operating curves of 3-way water valve and dry cooler pump

- **combined operation (Freecooling + mechanical cooling)** - the pump works as described above and the 3-way water valve is in condensation control mode following the local condensation temperature, so a portion of water chilled by the dry cooler is also used to control condensation.

4.9 Multifree: compressor stop

In freecooling units, the use of compressors to meet the thermoregulation demand is dependant on the air temperature.

Generally, when the air temperature value is low, the thermoregulation demand is met by the freecooling function.

Particular conditions can occur during system start-up which may require temporary activation of the compressors.

Systems with the Multifree function enabled are characterised by the fact that the Master unit manages this control and prevents compressor activation, using only the freecooling function to meet the load demand.

The air temperature value below which compressor activation is prevented is set in parameter MS_FC18.

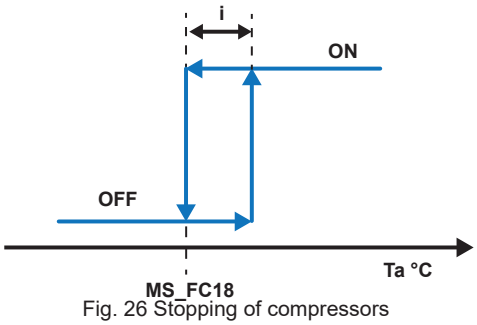


Fig. 26 Stopping of compressors

The abbreviations of the graph indicate:

- MS_FC18 = compressor stopping temperature
- i = hysteresis (parameter set from code)
- Ta = air temperature

4.10 Multifree: system types

Examples of systems featuring freecooling units are given below. These examples consist in outline diagrams which illustrate how the Multilogic and Multifree functions work and include the min. requirements for correct system operation.

Please keep in mind that the Master unit in Multilogic / Multifree systems must be supplied with the freecooling function.

The abbreviations in the graphs include:

- M = Master unit
- S = Slave unit
- BTM2 = common temperature probe on delivery line in Multilogic system;
- BTM1 = common temperature probe on return line in Multilogic system;
- BT20 = temperature probe on common delivery line to dry coolers (dry cooler inlet);
- BT43 = temperature probe on common return line from dry coolers (dry cooler outlet);
- BT3 = outside air temperature probe.
- Hc = hydraulic circuit breaker or manifold
- Sc = secondary circuit
- Vnr = non-return valve
- Vw= water on/off valve;
- Pu = unit electric pump on user side (it may be one in each individual unit or one for the entire system; it may be fixed or variable flow rate, with the limitations explained above);
- Ps = unit electric pump on source side (based on the specifications for condensation control).

The yellow dotted line defines the area of action the Multilogic management function. The water probes installed on each individual unit (BTM1, BTM2, BT20 and BT43), which are specifically designed for the Multilogic function, are wired on the Master controller at the factory. The system may be connected to an external BMS for remote monitoring. A network switch is fitted inside the Master unit to physically implement the connection between the units.

Probe BT3 too is an outside air probe wired to the Master.

All the outside air temperature probes BT3 must be wired in water/water units with freecooling NG, including Slave units, for local controls.

The same instructions given for the Multilogic system concerning the supply of options, if any, and with reference to the management of the water on/off valve on the user side apply in this case too.

No modulating valves on the source side are included as the freecooling no glycol circuit uses the dry cooler, a 3-way modulating water valve and a source-side inverter pump, which are both inside the unit.

Contact the manufacturer for additional details on the other types of systems that are not contemplated herein.

The installer must implement the system in compliance with the existing regulations at both national and local level.

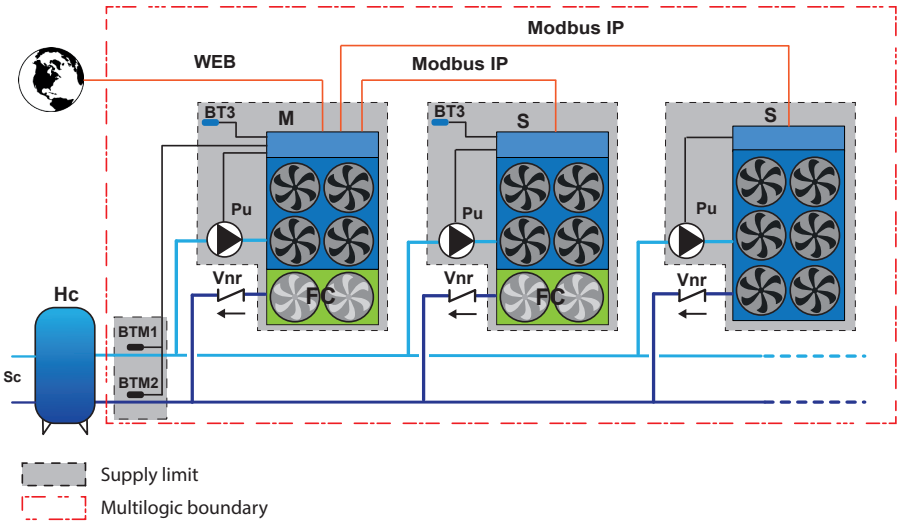
4.10.1 Multifree: units with dedicated user-side pumps

Pu pumps are mounted on every single unit although the system actually operates at variable flow rate as the number of active pumps is variable and depends on the thermal load (“PA1=2” on units connected to the Multilogic-Multifree network).

The same instructions given for the Multilogic system apply in connection with the Flowzer VP and Flowzer VDE options.

The diagram below shows the pump “outside the unit”: both configurations are possible - with pump installed onboard or outside the unit. Considering the type of system specified, the pump must be controlled by the unit directly in both cases.

EXAMPLE Air/water unit



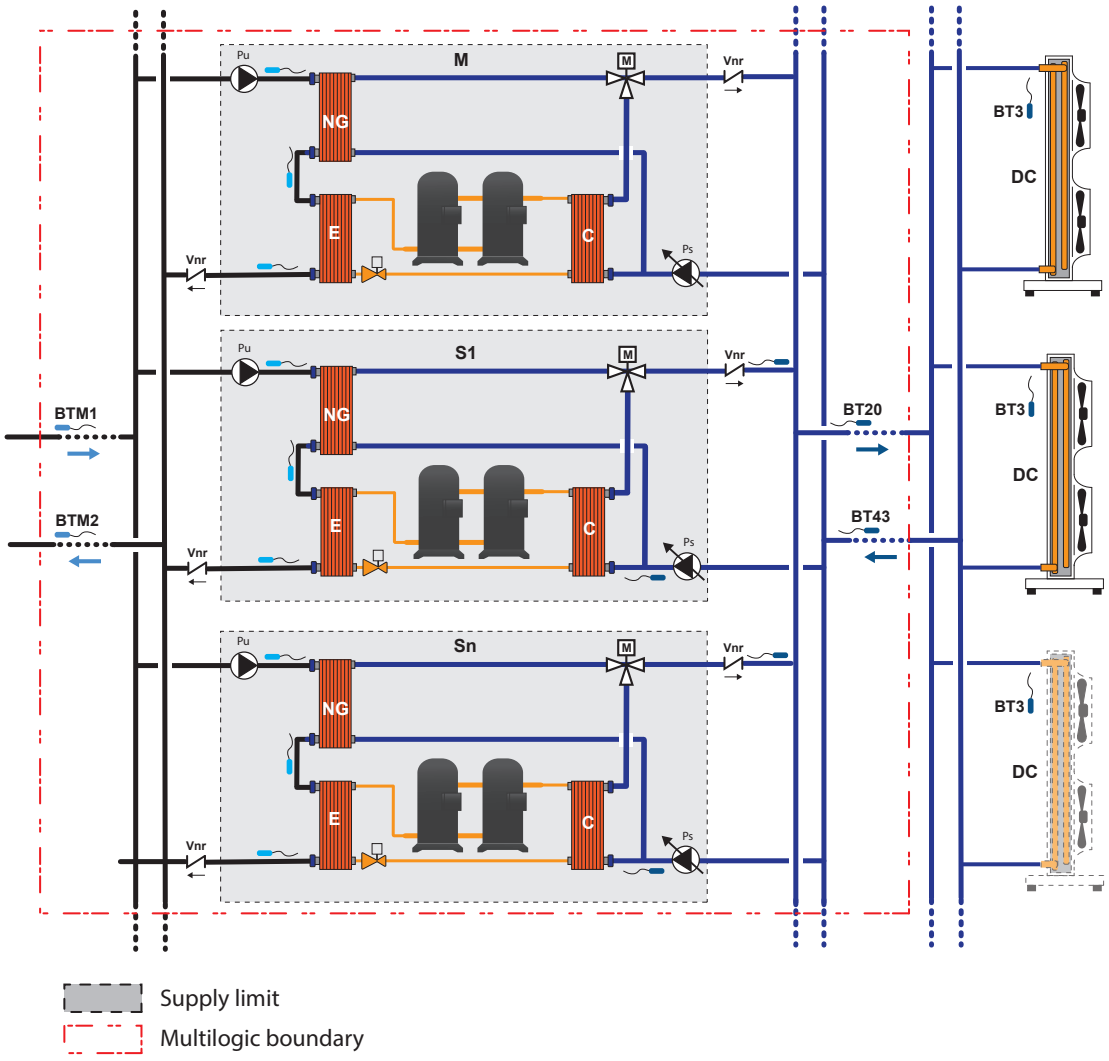
EXAMPLE water/water unit

As regards the user side, this configuration has no differences in terms of water pump management with respect to an air/water installation: the arrangements illustrated above must be followed.

As for condensation control, each unit manages condensation control independently from the other units, following the local readings. Each unit also outputs a 0..10V signal to and has an on/off contact for the dry cooler controller which needs to be managed correctly, based on the hydraulic connection type. It is anyway important to always provide for the worst case water flow on the system/installer side.

The system conditions may include:

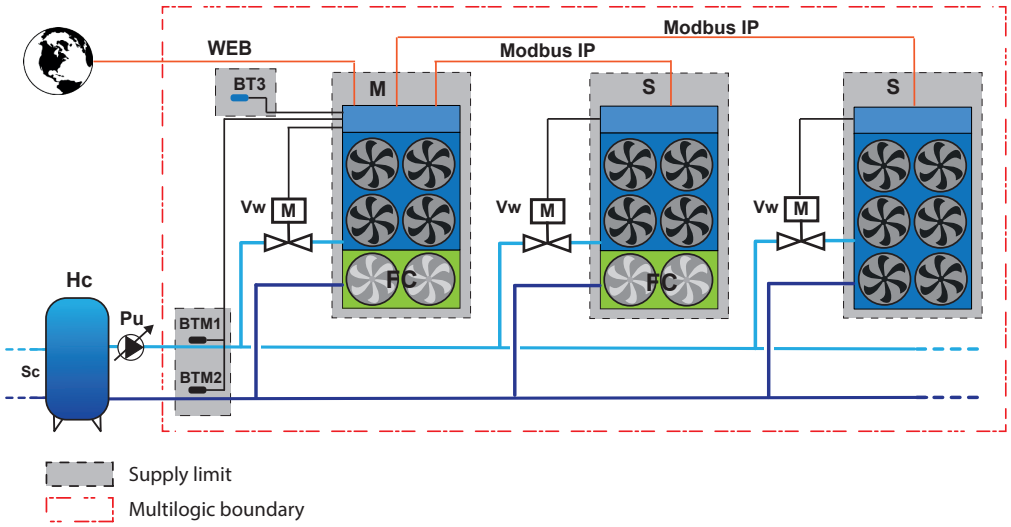
- source side common to units (as shown in the following diagrams: the hydraulic part is common and the dry coolers operate as one single block, based on which the installer shall provide for an additional controller intended to send the dry coolers the greatest among all individual signals);
- source side independent (each unit is directly connected to the its corresponding dry cooler both electrically and hydraulically).



4.10.2 Multifree: unit with external centralized pumping system

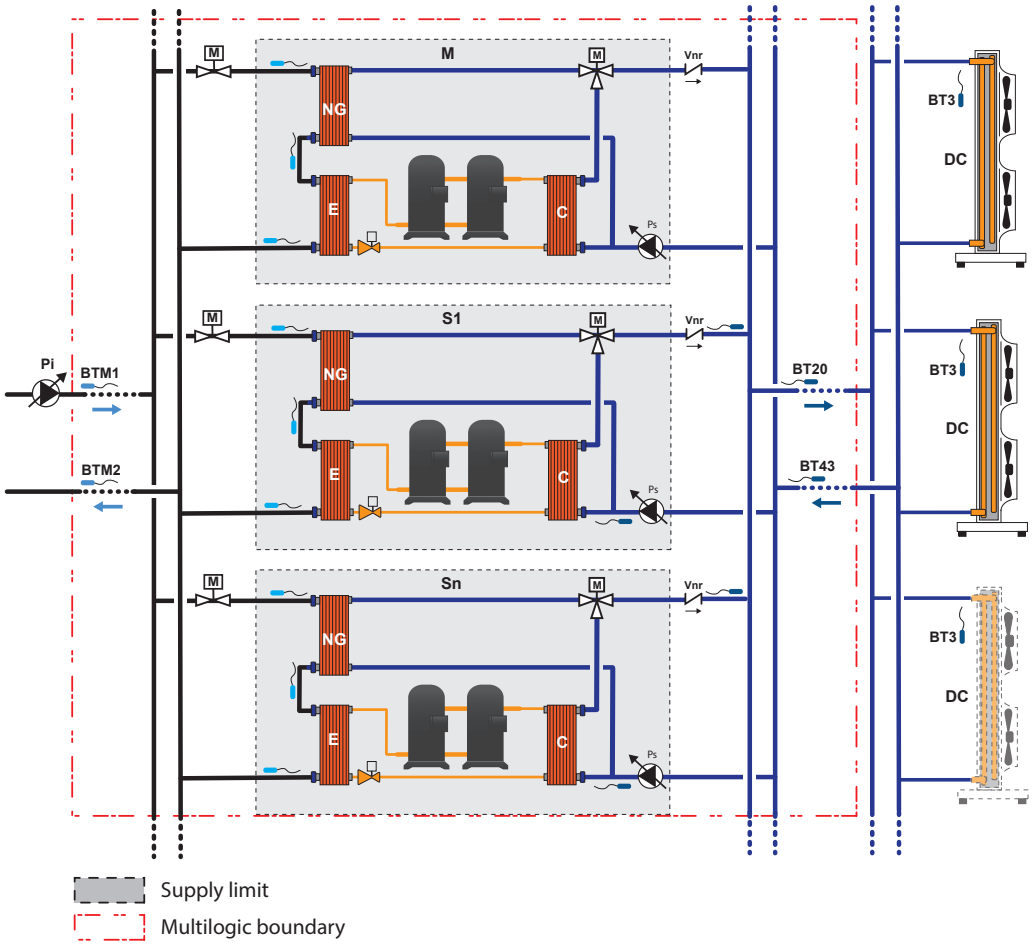
The system consists of one single external pumping unit that controls the entire system (external option). The Multilogic function controls opening and closing of the water valves, where fitted and if their management has been requested. In any case, management of the flow rate (either variable or fixed) of the centralized pump falls under the responsibility of the client who shall guarantee the min. flow rate to the heat exchangers under all conditions.

EXAMPLE Air/water unit



EXAMPLE water/water unit

The same observations on the user and source sides expressed while commenting the diagrams above apply in this case too. The external centralized pumping system is intended to be the one on the user side, not on the source side.

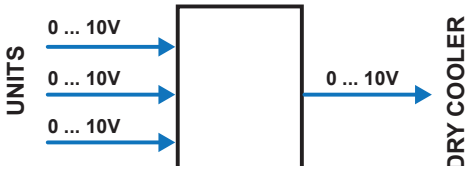


4.10.3 Instructions for correct system operation

The installer should make sure that, but not limited to it:

- install a check valve at the user-side outlet of each unit to prevent water recirculation when the pump of the unit is not running; if the installation includes an external centralized pumping system, the check valves at the unit outlet **are not required**: recycling is avoided and the water valve is fully closed;
- non-return valves are installed if the source side has dedicated pumps for each unit;
- sensors BTM1 and BTM2 of the Master unit need to be correctly installed (in the common sections of the system) and so are sensors BT20 and BT43 of the Master unit (in the common sections of the system connected to the dry coolers): suitable pockets (correct length and diameter) are used for the featured probes so that each probe is correctly fitted “in the water flow” and an appropriate heat conducting paste is used to enhance the reading accuracy of the probe;
- all BT3 sensors in the units need to be correctly installed (Master unit and Slave units with freecooling water/water, no glycol units). Temperature probes must be installed in the shade for correct reading or in such way that they are not exposed to direct sunlight or facing north to prevent the measurement from being affected; With water / water free cooling no glycol unit, the respective BT20 probe must also be installed on site, while the respective BT43 probe is already installed in the hydraulic module.
- the installer must ensure the correct min. flow rate to the heat exchangers of each unit is checked under all operating conditions, both on the user side and on the source side when it comes to water/water units;
- the external pumps or the water on/off valves for each individual unit are fitted;
- suitable water filters need to be installed in the system;
- the system needs to be implemented in compliance with good installation practices and **the existing regulations** (by way of exemplification, but not limited to it, through the installation of expansion joints, where required, air vents at the highest points of the system, safety valves, expansion vessels, etc.).

For correct management of the condensation temperature and the local freecooling conditions, water/water systems in which the hydraulic system is common to all the units and the dry cooler fans operate as a single fan require that an external controller is fitted to read the greatest analogue signal (0-10V) of each unit that is then sent to the dry cooler unit.



Although the system diagrams are functional diagrams, they show the correct locations of devices (probes, non-return valves, etc.) to the system.

4.11 Multifree system pages

All information regarding the function is given in some specific pages.

As the “Multifree” function is part of the “Multilogic” function, access to the Multifree system pages requires clicking of the “Multilogic” button on the main page.

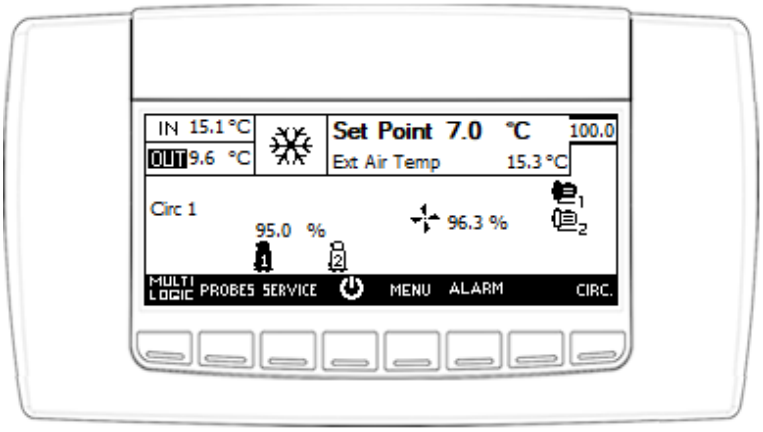


Fig. 27 Main controller screen

4.11.1 Pages of Master unit – Air/Water Freecooling

When in the Master system pages, the Multilogic screen shows the capacity required by the system on the left hand side of the first page, split between the mechanical cooling demand to be met using compressors (acronym CH in top left-hand bar) and the demand to be met with freecooling (acronym FC in bottom left-hand bar).

The right side shows the percentage capacity to be met using the compressors, as output by the Multilogic system to the Master unit, and its set priority.

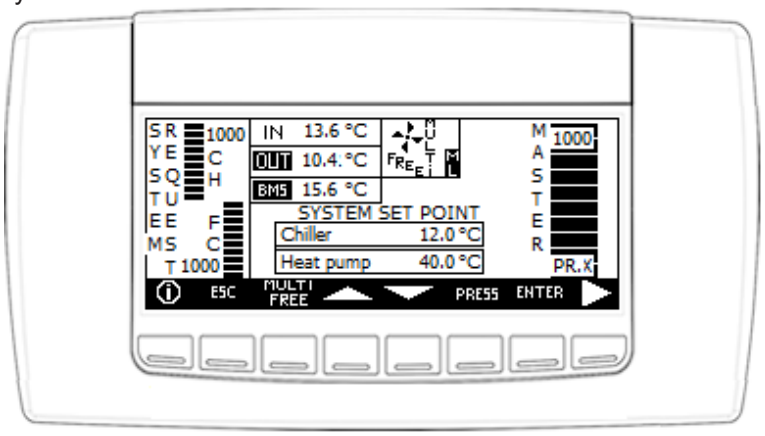


Fig. 28 Main screen of the Master regarding the Multilogic system with Multifree function active

The top central area shows the water temperature values as detected by the probes on the common return (IN) and delivery (OUT) lines of the system (probes BTM1 and BTM2 in the above diagrams), the operating status and alarms, if any (the “alarm” symbol is displayed).

The text “**ML**” steady, indicate s that the units are online, if "**ML** is flashing, at least one unit is offline and "AL16" appears.

The term “**OUT**” indicates that the Multilogic function reads the water temperature on the probe fitted on the common system delivery line.

The bottom central part displays the setpoint values of the system regarding the operating mode. The setpoint values can be changed using the “arrow up” and “arrow down” buttons. After changing a value, it must be confirmed pressing the “Enter” button.

A click on the “Esc” button gives access to the main screen.

Press the “RH arrow” key to access the screen displaying all the present in the case of group installations.

A click on the “arrow lh” button gives access to the previous page.

The following image shows 4 groups making up an installation consisting of 32 units.

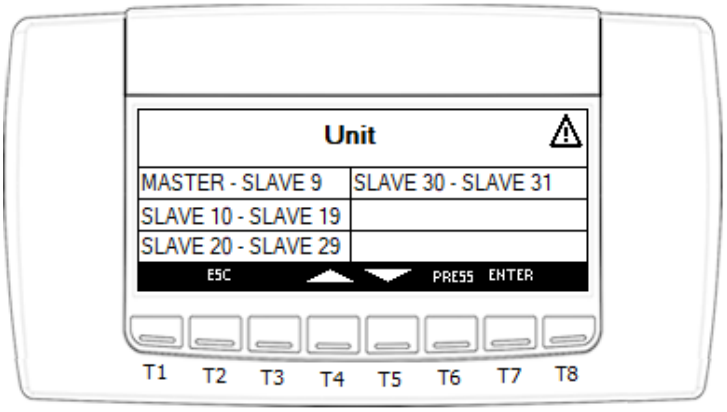


Fig. 29 Master Screen displaying all the units present in the installation

Use the arrow keys to select one of the groups of units and press “Enter” to view the main operating parameters.

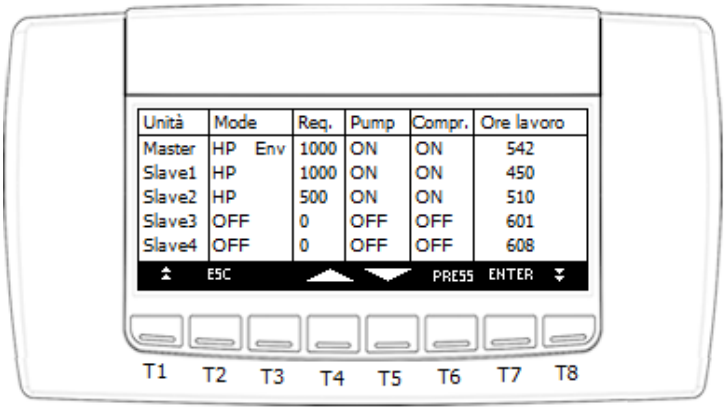


Fig. 30 Selected unit screen

The main operating parameters displayed on the screen are:

- unit name;
- the operating mode (OFF, CH, FC or ACS) and, in configurations that include the option of maintaining at least one compressor inside the envelope active, and the function is enabled, the message “Env”;
- request, expressed in thousandths of the unit;
- status of the pumps (OFF, ON, Disabled);
- status of the compressors (Off or ON);
- unit working hours.

Use the arrow keys to select one of the units in the group and press Enter to conform and access screen where the information relating to the function are displayed.

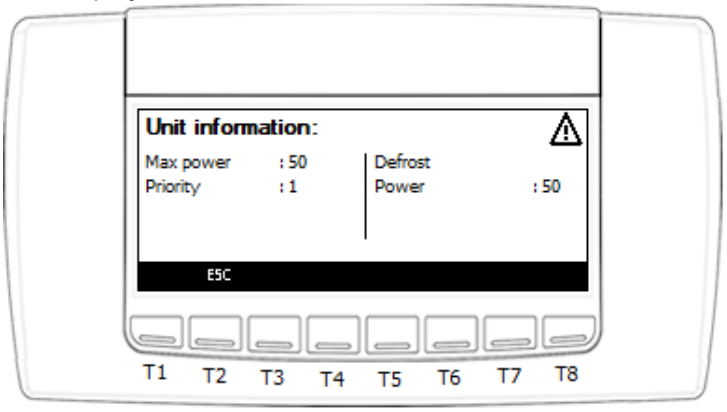


Fig. 31 Selected unit screen

The following values are displayed on the unit information screen:

- maximum power delivered by the unit, expressed as a percentage;
- priority;
- defrosting power (if the unit is in heat pump mode).

Access to the Multifree section of the system is gained by going back to the Multilogic / Multifree summary screen of the Master unit and clicking the “Multifree” button. The wording appearing on screen varies according to the freecooling type and the units featured.

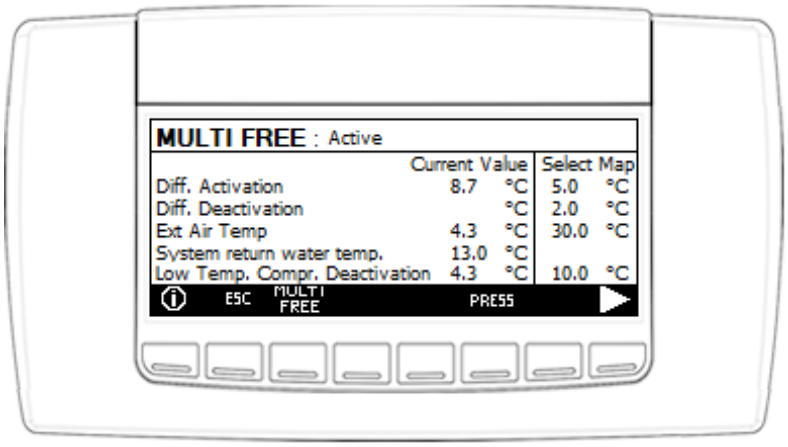


Fig. 32 Air/water units with separate ventilation management

The column “Current Value” shows readings in real time; the column “Select Map” shows the setpoint values in the controller.

The table below is provided for better understanding of the values displayed.

	Current Value		Select Map	
Diff. Activation	BTM1 – BT3	°C	MS_FC7	°C
Diff. Deactivation	--		MS_FC8	°C
Ext air Temp	BT3	°C	MS_FC17	°C
System return water temperature	BTM1	°C	--	
Low Temp. Compr. Deactivation	BT3	°C	MS_FC18	°C

In the table (with reference to diagrams above):

- BTM1 = common temperature probe on return line in Multilogic system;
- BT3 = outside air temperature probe.

The Multifree function is disabled by tapping the “Multifree” button for approx. 2 seconds: the icon corresponding to the “Multifree” button now appears as checked out.

A click on the “arrow rh” button gives access to two different screens, based on the unit freecooling type.

4.11.1.1 Master – Separate ventilation

If the unit has separate ventilation signals for the freecooling section and the condensing section, the displayed screens show the percentage corresponding to the signal of the freecooling fans and the status of the freecooling valve for units with standard freecooling, whereas the status of the pump (in place of the valve), of the flow switch and of the thermal overload protection is displayed for no glycol units.

A click on the “arrow lh” button gives access to the previous page.

The alarm symbol on the top right hand side means that Multifree alarm conditions are active, which need to be checked (e.g. unit offline).

Standard version

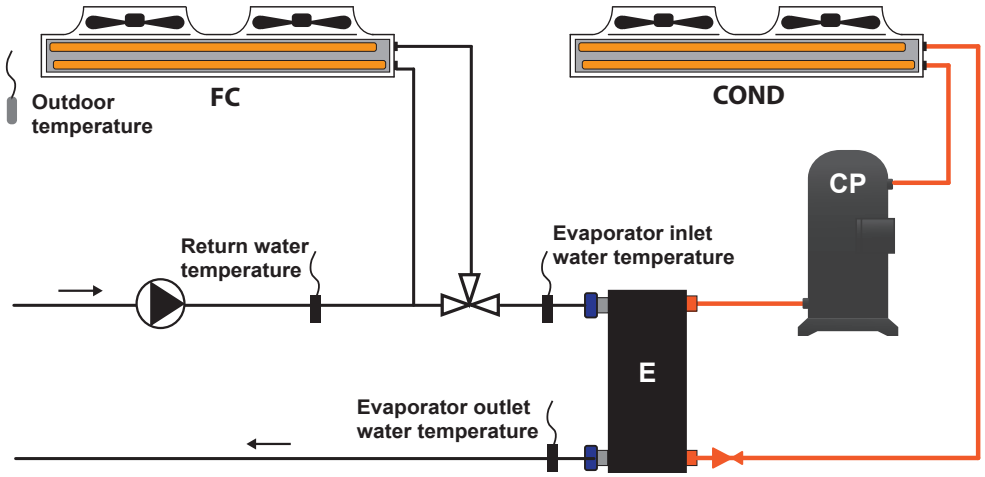


Fig. 33 Illustration diagram

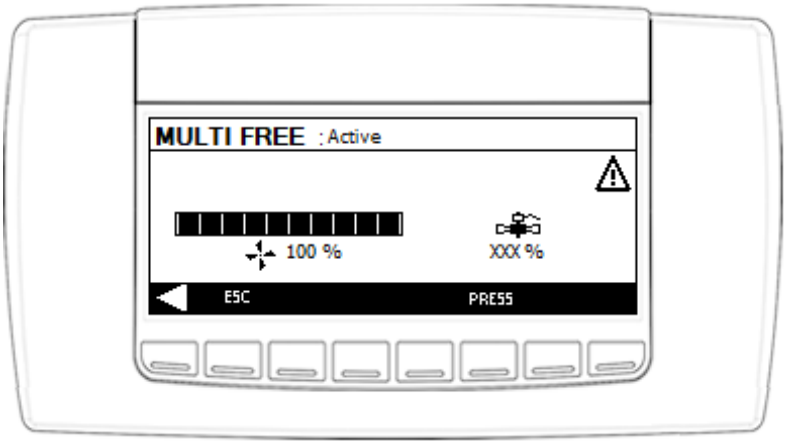


Fig. 34 Master screen for standard version

No glycol version

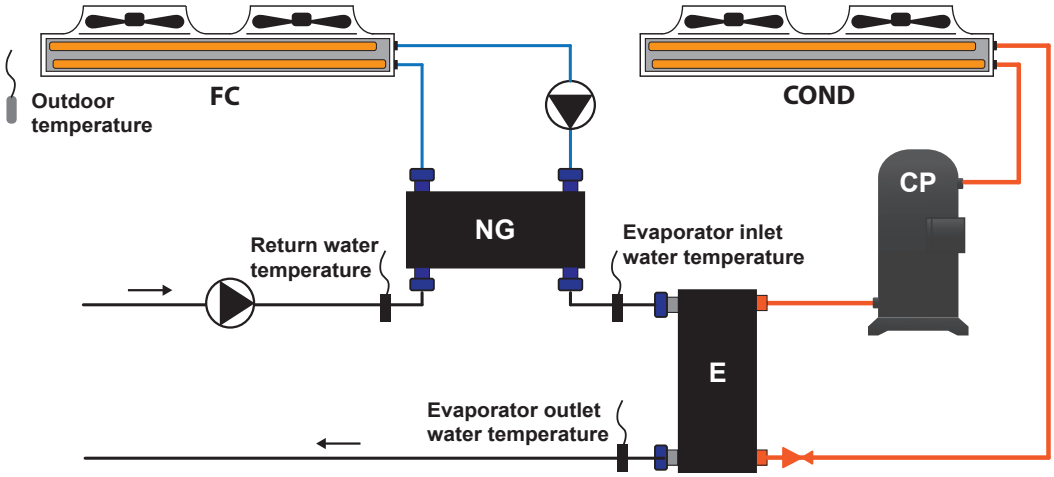


Fig. 35 Illustration diagram

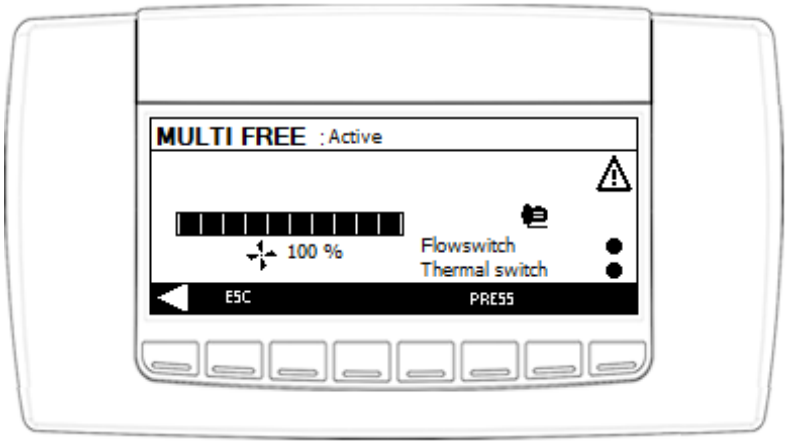


Fig. 36 Master screen for no glycol version

4.11.1.2 Master – Common ventilation

If the unit has one single ventilation signal for both the freecooling and the condensing sections, the displayed screen shows the hydraulic circuit with the involved measured values and the status of the compressors.

The screen shows the temperature of water coming from the system and the inlet and outlet temperatures from the evaporator, the status of the 3-way water valve, the common ventilation percentage, and the outside air temperature.

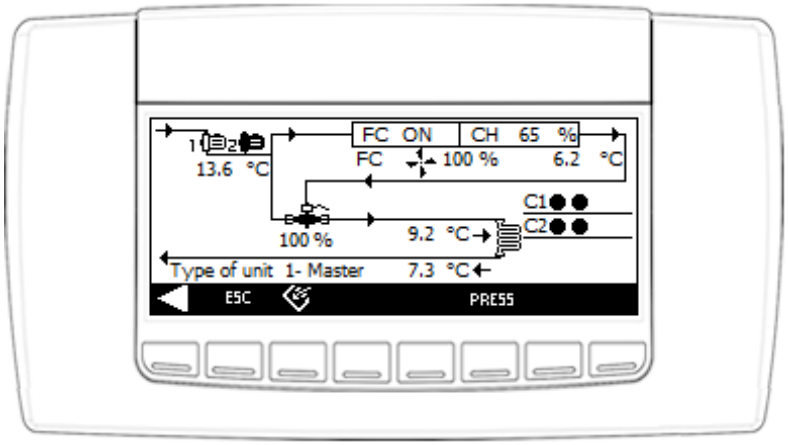


Fig. 37 Air/water units with common ventilation management

A click on the “Freecooling” button disables the freecooling function of the Master unit only: the icon corresponding to the “Freecooling” button now appears as checked out.

A click on the “arrow lh” button gives access to the previous page.

4.11.2 Pages of Slave units – Air/Water Freecooling

When in the Slave unit pages, the Multifree screen shows information that vary according to the type of freecooling configuration.

4.11.2.1 Slave – Separate ventilation

If the unit has separate ventilation signals for the freecooling section and the condensing sections, the demand for mechanical cooling capacity from the Master unit to the Slave unit and the Slave priority are displayed on the left hand side of the screen in both standard freecooling and no glycol versions (the illustration diagrams are provided in the section with the Master system pages).

The top area in the display shows:

- Slave online - inlet and outlet water temperatures to / from the system;
- Slave offline - inlet and outlet water temperatures to / from the unit.
- the term “**OUT**”, which indicates that the function reads the water temperature on the probe fitted on the delivery line;
- the wording “SLAVE UNIT OFF-LINE” with the “alarm” symbol, which indicates that communication with the Master is missing.

A click on the “Esc” button gives access to the main screen.

The displayed parameters change in “No Glycol” version where the freecooling valve is replaced by the pump, the water flow switch and the thermal overload protection of the pump in the freecooling circuit.

MULTIFREE - SEPARATE VENTILATION

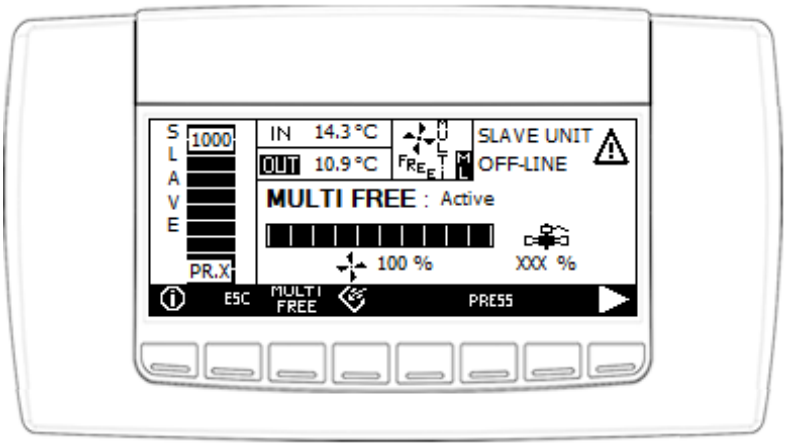


Fig. 38 Slave screen for standard version

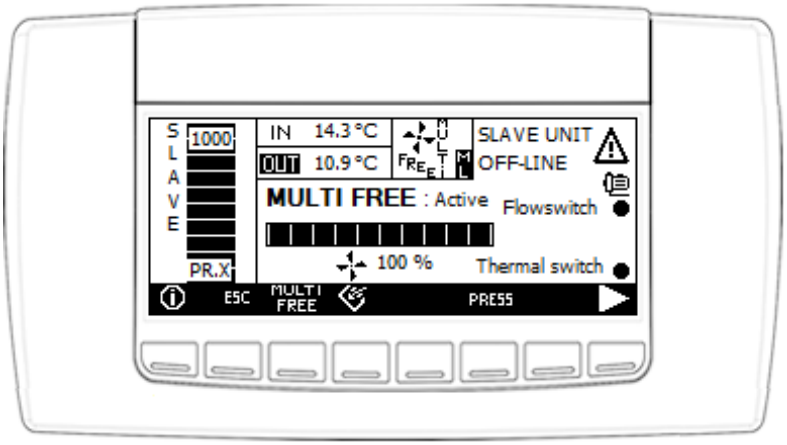


Fig. 39 Slave screen for no glycol version

The Multifree function is disabled by tapping the “Multifree” button for approx. 2 seconds: the icon corresponding to the “Multifree” button now appears as checked out.

A click on the “Freecooling” button disables the freecooling function of only the Slave unit to which the display is connected: the icon corresponding to the “Freecooling” button now appears as checked out.

4.11.2.2 Slave – Common ventilation

If the unit has one single ventilation signal for the freecooling and the condensing sections, the screen features the “arrow rh” button in both the standard freecooling and the no glycol versions. A click on the “arrow rh” button gives access to an additional page in which, in this case too, the displayed parameters vary according to the freecooling configuration and the compressor type.

A click on the “Freecooling” button disables the freecooling function of only the Slave unit to which the display is connected: the icon corresponding to the “Freecooling” button now appears as checked out.

A click on the “arrow lh” button gives access to the previous page.

A click on the “Esc” button gives access to the main screen.

MULTIFREE - COMMON VENTILATION

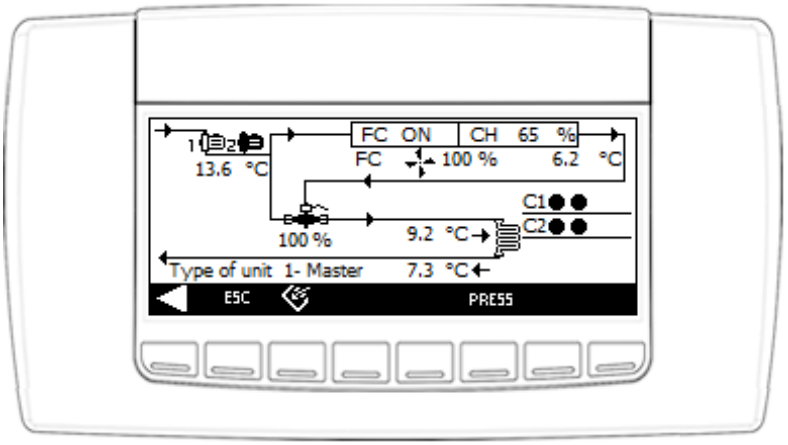


Fig. 40 Slave unit with scroll compressors and in standard version

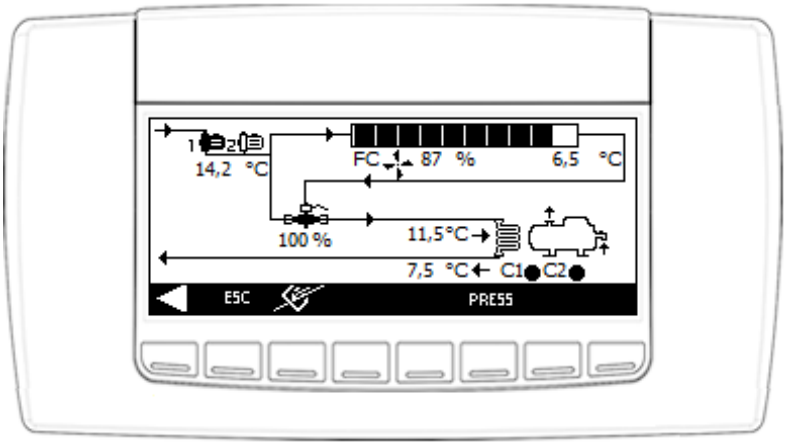


Fig. 41 Slave unit with screw compressors and in standard version

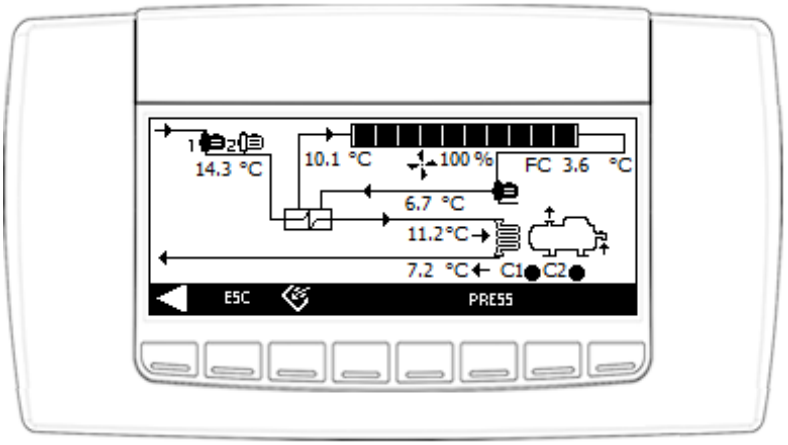


Fig. 42 Slave unit with screw compressors and in no glycol version

4.11.3 Pages of the Master unit – Water/water freecooling, no glycol unit

A click on the “Multilogic” button on the main page gives access to the first Multilogic/Multifree page that has already been indicated in section “Pages of the Master unit – Water/water freecooling” above. A click on the “Multifree” button on this page gives access to two different screens, depending on whether the Master unit is on- or offline.

4.11.3.1 Master online

The column “Current Value” in the summary screen of the Master Multifree status shows readings in real time; the column “Select Map” shows the setpoint values in the controller.

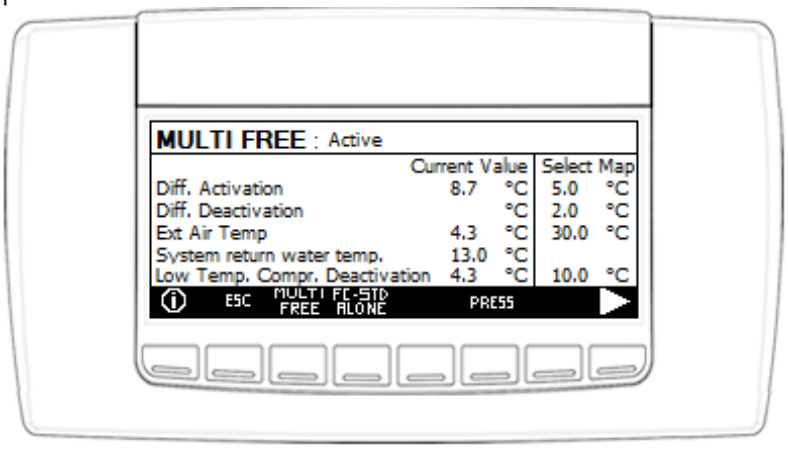


Fig. 43 Water/water units - General Master Multifree screen

The table below is provided for better understanding of the values displayed.

	Current Value		Select Map	
Diff. Activation	BTM1 – BT3	°C	MS_FC7	°C
Diff. Deactivation	--		MS_FC8	°C
Ext air Temp	BT3	°C	MS_FC17	°C
System return water temperature	BTM1	°C	--	
Low Temp. Compr. Deactivation	BT3	°C	MS_FC18	°C

In the table (with reference to diagrams above):

- BTM1 = common temperature probe on return line in Multilogic system;
- BT3 = outside air temperature probes

The Multifree function is disabled by tapping the “Multifree” button for approx. 2 seconds: the icon corresponding to the “Multifree” button now appears as checked out.

A click on the “arrow rh” button gives access to the following page.

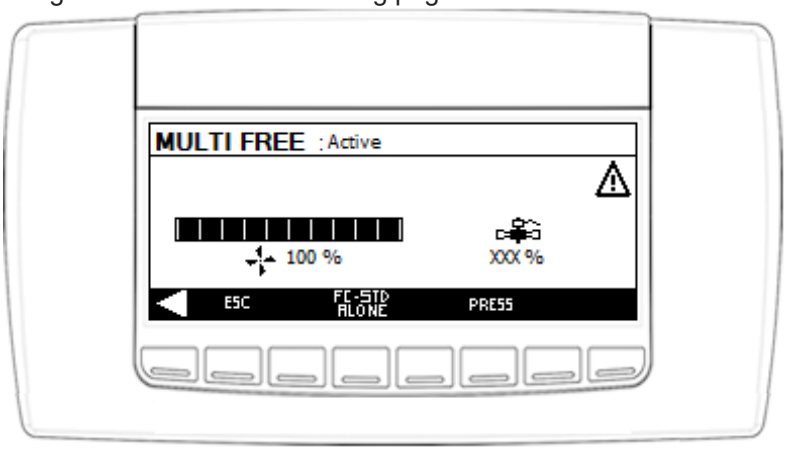


Fig. 44 Water/water units - Specific Master Multifree screen

A click on the button “FC-STD ALONE” gives access to the FC area of each Master unit (the description below applies to these units offline).

A click on the “arrow lh” button gives access to the previous page.

The “alarm” symbol on the top right hand side means that Multifree alarm conditions are active, which need to be checked (e.g. unit offline).

4.11.3.2 Master offline

A click on the “Freecooling” button on the main page gives access to the freecooling status summary screen, as the Master unit works in freecooling and standalone mode if the necessary conditions exist.

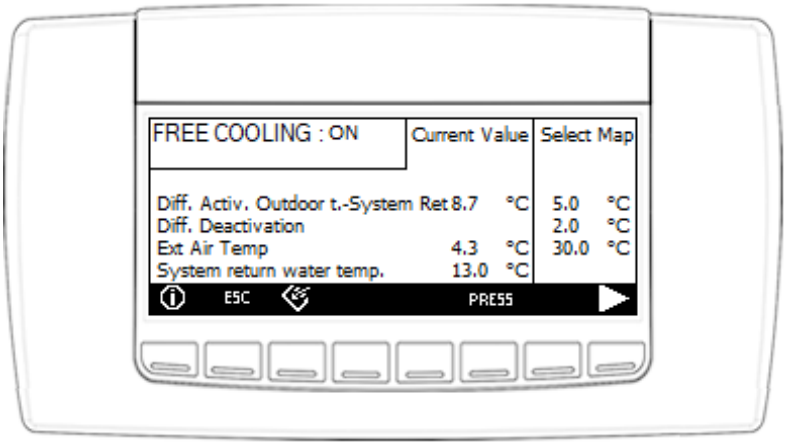


Fig. 45 Water/water units - General Master freecooling screen

The column “Current Value” shows readings in real time; the column “Select Map” shows the setpoint values in the controller.

The table below is provided for better understanding of the values displayed.

	Current Value		Select Map	
Diff. Activ. Outdoor t-Sistem Ret.	BTM1 – BT3	°C	FC7	°C
Diff. Deactivation	--		FC8	°C
Ext air Temp	BT3	°C	FC17	°C
System return water temperature	BTM1	°C	--	

In the table (with reference to diagrams above):

- BTM1 = common temperature probe on return line in Multilogic system;
- BT3 = outside air temperature probes

A click on the “arrow rh” button gives access to the following page.

A click on the “Freecooling” button disables the freecooling function of the Master unit to which the display is connected: the icon corresponding to the “Freecooling” button now appears as checked out.

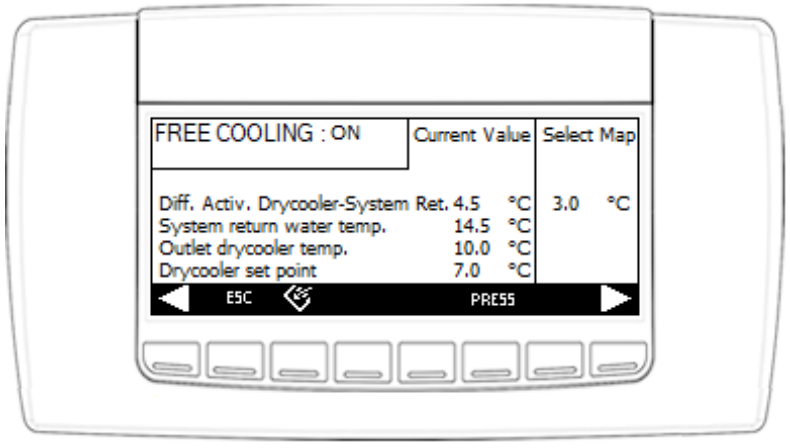


Fig. 46 Water/water units - Specific Master Multifree screen

The column “Current Value” shows readings in real time; the column “Select Map” shows the setpoint values in the controller.

The table below is provided for better understanding of the values displayed.

	Current Value		Select Map	
Diff. Activ. Drycooler t-Sistem Ret.	BTM1 – BT43	°C	FC13	°C
System return water temperature	BTM1	°C		
Outlet drycooler temperature	BT43	°C		
Drycooler setpoint	ST1 – FC30	°C		

In the table (with reference to diagrams above):

- BTM1 = common temperature probe on return line in Multilogic system;
- BT43 = temperature probe on common return line from dry coolers (dry cooler outlet);
- ST1 = Setpoint – Chiller (it must be aligned with MS49);
- FC30 = water/water unit FC-NG – Dry cooler – Setpoint offset in freecooling

A click on the “arrow rh” button gives access to the following page.

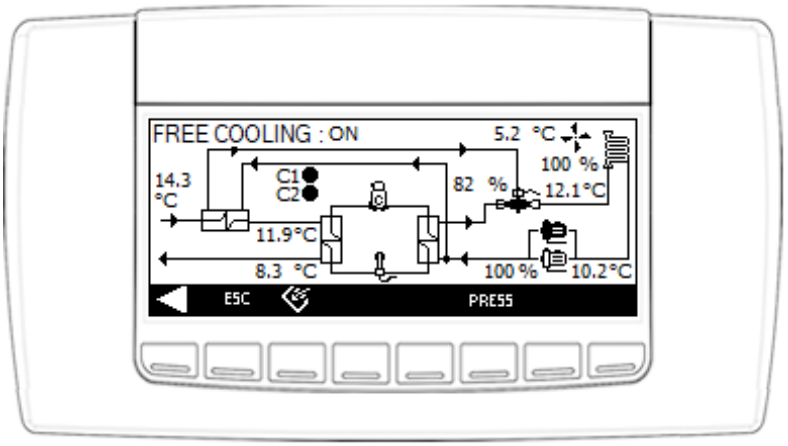


Fig. 47 Water/water units - Specific Master freecooling screen showing readings and devices

4.11.4 Pages of the Slave unit – Water/water freecooling, no glycol unit

A click on the “Multilogic” button on the main page gives access to the first Multilogic/Multifree page that has already been indicated in section “Pages of the Master unit – Water/water freecooling” above. A click on the “Multifree” button on this page gives access to the following screen.

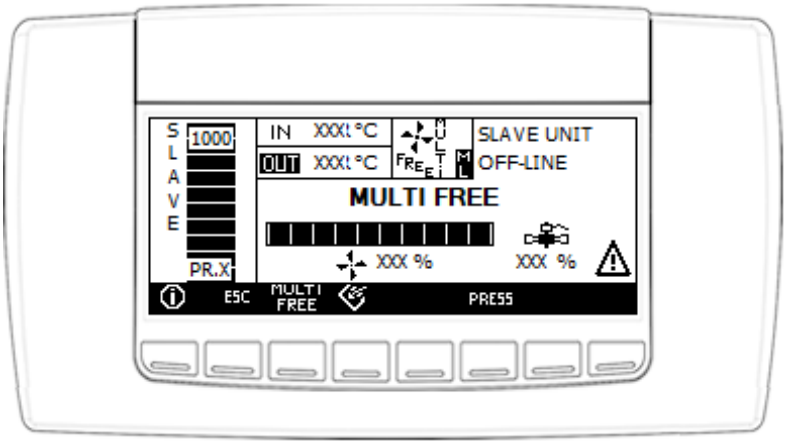


Fig. 48 Water/water units - Specific Slave freecooling screen

If the Slave unit is offline, the alarm symbol appears together with the message “Slave unit offline”.

The other buttons featured have the same function described for the other pages.

4.12 Multifree: Alarms

Alarms linked to this function are the same as for the Multilogic system plus those listed below.

AL83	**Ambient air temperature probe error**
Reason for activation	When the value measured by the analogue input is outside the set operating range
Reset	When the value of the analogue input falls within the set operating range.
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Master	The Freecooling and Multifree functions are disabled (together with all functions connected to the air temperature).
Other units	The Freecooling and Multifree functions are disabled (together with all functions connected to the air temperature).

5 MULTILOGIC - MULTI-PURPOSE UNITS

The Multilogic function is designed to manage several multi-purpose units in hydraulic parallel for the production of either cold or naturally hot water on two hydraulically separate circuits. The solution is designed for connection of up to 32 units by way of a TCP/IP Modbus protocol using an Ethernet switch.

This system requires that one unit operates as **Master** and the other units as **Slave**: the **Master** unit queries the other Slave units and defines their operating mode.

On the basis of the information measured by the temperature probes installed in the system, the Master unit generates two capacity demands (one for the cold circuit and the other for the hot circuit). Capacity demands are analysed and distributed to the various units.

For better energy savings, priority is given to the water/water operating mode.

If there is no communication between the units, they can continue to work or go into standby mode, while awaiting commands from the Master or from the technical support personnel.

The function “Multilogic – Multi-purpose units” is only available for units supplied with an advanced “IPro” controller.

5.1 Principle of operation of the Multilogic system

The operating logic of a Multilogic system is essentially based on 3 distinct steps which are continuously performed by the control logic.

STEP 1 Thermoregulation

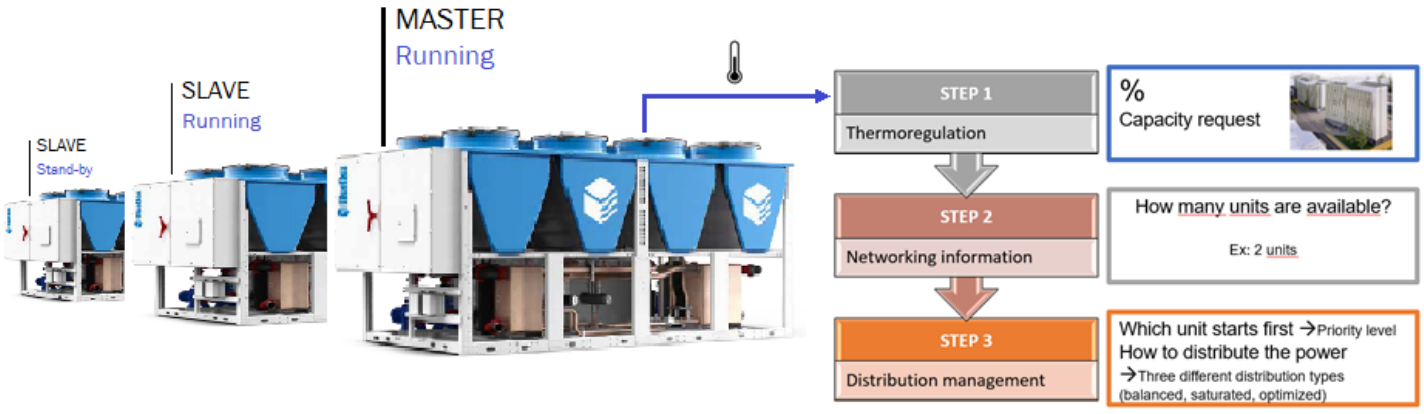
- During thermoregulation, the system probes that monitor the Multilogic system are connected to and controlled by the Master unit. The probes are placed at common points on the system delivery and return lines on both the hot and cold sides and the Master unit calculates the capacity demand based on the values measured by the control probes.

STEP 2 Networking

- The Master unit subsequently communicates with the other Slave units to understand how many of them are available.

STEP 3 Capacity distributions

- The required capacity is split among the available units according to the distribution logic that has been preset in the system and to the preset priority level of the units.



5.2 Multilogic - Multi-purpose units: alternatives and constraints

Multilogic systems only operate with the “Ipro” advanced controller if the connected units **have the same** software version.

A Multilogic network cannot operate with different software versions/releases.

Connections with the following **are** admitted in a Multilogic system:

- 4-TUBE MULTI-PURPOSE air/water units only, without limitations with respect to size or compressor type.

The Multilogic system **is not compatible** with:

- systems featuring multi-purpose units together with CH, CH+FC, HP units;
- flowzer VD, VPS and VFPP;
- PFP, user-side pump with pulse function.

The Flowzer VP or Flowzer VDE options are the only ones that can be fitted together with the Multilogic option because they operate similarly to an on/off pump, although they are supplied with an inverter-controlled pump. In this case, however, the co-existence of these options should be examined in advance in order to evaluate the flow rates concerned.

5.3 Multilogic - Multi-purpose units: parameters

All parameters involved in the setup of the Multilogic function are listed in the following tables, sorted by their relevant group, where a basic description is also provided to explain the meaning of each parameter concerned. This should help the user more easily understand the settings described below. Please note that the most frequently used parameters are described in depth in the following sections. Please note that **the most frequently used parameters** are described in depth in the following sections.

It is worth pointing out that some parameters have a different reference if compared to Multilogic parameters for chillers and heat pumps (hereinafter **Std MS**), although they have the same meaning. This is the reason why an additional column has been added referencing the corresponding parameter in the standard Multilogic system for easier understanding.

If units are connected in Multilogic configuration, each unit must be left ON with both the cold and hot side enabled. The Master controls which units will be operational and which ones will not (i.e. units with compressors and pumps off). If one side is disabled, AL15 will appear on the Master screen. The Master unit will in any case manage the unit of the section that is still active.

Please remember that when parameters are changed, especially “MS” parameters, the unit must be in the “OFF” state. If it is not, restarting of the controller may occur.

5.3.1 CF – Configuration parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
All units	CF11	*Network configuration* 0 - Stand-alone 1 - Master 2 - Slave In the Multilogic network the value of CF11 identifies the type/role of the unit. When CF11 is set to 1, the unit is the Master unit; when CF11 is set to 2, the unit is a Slave unit. When CF11 is set to 0, the unit is excluded from the Multilogic network.	CF11

5.3.2 PA – Pumps parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
All units	PA1	*Cold side - Pump management* 1 – Continuous operation 2 – Compressor-dependant operation When in a Multilogic network, **“PA1” must be set to 2** as the number of pumps ON must be controlled by the Master unit. If “PA1 = 1”, the water pump is always ON and it is not controlled by the Master unit.	PA1
All units	PA24	*Hot side - Pump management* 1 – Continuous operation 2 – Compressor-dependant operation When in a Multilogic network, **“PA24” must be set to 2** as the number of pumps ON must be controlled by the Master unit. If “PA24 = 1”, the water pump is always ON and it is not controlled by the Master unit.	---

5.3.3 SP – Setup parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
All units	SP12	*BMS serial address* Range: 1 .. 247 SP12 specifies the serial address of the units that is also used in the Multilogic configuration. Please note that address 1 must be associated with the Master unit (for which the lowest address must be set); as for Slave units, the sequence of serial addresses must match the sequence of IP addresses indicated below.	SP12

5.3.4 MS – Multilogic parameters: most frequently used parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
Master	MS2	*Number of units involved (including Master)* Range: 2 .. 32 MS2 identifies the **total** number of units that are connected in the Multilogic network, including the Master unit. For instance, 4 is the value to be entered if the system has 1 Master unit and 3 Slave units.	MS2
All	MS4	*Unit operation in presence of an offline alarm* 0 - the Master unit switches to OFF. 1 - the Master operates in standalone mode. MS4 defines the behaviour of the **Unit** when alarm AL16 triggers and the Unit is offline and stops communications	MS4
Master	MS49	*Cold side - Setpoint* Range: MS50 .. MS51 This setpoint must be set up when the Multilogic operates in chiller mode. It must be set according to the control probe, the system requirements and the operating limits.	MS49
Master	MS55	*Cold side - With NZ or PID - Activation zone offset* Range: 0,1 .. 25,5°C. This parameter defines the band to calculate the compressor activation times on the cold side when the reference temperature exceeds “MS49+MS67”. It must be set up according to the system requirements.	MS55
Master	MS57	Cold side - With NZ or PID - De-activation zone offset Range: 0,1 .. 25,5 °C. This parameter defines the band to calculate the compressor de-activation times on the cold side when the reference temperature is below the setpoint specified in “MS49”. It must be set up according to the system requirements.	MS57
Master	MS67	*Cold side - With NZ or PID - Band* Range: 0,1 .. 25,5 °C MS67 is the neutral zone on the cold side. When the temperature ranges between setpoints “MS49” and “MS49+MS67”, the thermoregulation system calculates the required capacity demand increase at a manufacturer-set percentage only if the capacity demand is greater than 0%, otherwise the increase will be 0%. It must be set up according to the system requirements.	MS67
Master	MS69	*Number of backup / booster units* Range: 0 .. MS2. MS69 sets the number of units that are OFF for backup purposes during normal regulation. The value is set according to the system requirements. The Master unit actively controls a number of units equal to MS2-MS69 for thermoregulation. If the Multilogic network has 4 units and 1 is in backup mode, there are 3 units normally ON.	MS69
Master	MS71	*Unit rotation time* Range: 0 .. 999 hours, where 0 = rotation disabled. The purpose of unit rotation is to switch on units in backup and to switch off units that are ON: it is implemented as soon as the number of hours of operation stored in parameter MS71 is reached.	MS71
Master	MS82	*Hot side – Setpoint* Range: MS83 .. MS84 This setpoint must be set up when the Multilogic operates in the hot side. It must be set according to the control probe, the plant requirements and the operating limits.	MS52
Master	MS85	*Hot side – With NZ or PID – Activation zone offset* Range: 0,1 .. 25,5 °C. This parameter defines the band to calculate the compressor activation times on the hot side when the reference temperature is below “MS82-MS91”. It must be set up according to the system requirements.	MS56

5.3.5 MS – Multilogic parameters: most frequently used parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
Master	MS86	*Hot side – With NZ or PID – De-activation zone offset* Range: 0,1 .. 25,5 °C This parameter defines the band to calculate the compressor de-activation times on the hot side when the reference temperature exceeds the setpoint specified in “MS82”. It must be set up according to the system requirements.	MS58
Master	MS91	*Hot side – With NZ or PID – Band* Range: 0,1 .. 25,5 °C. MS91 is the neutral zone on the hot side. When the temperature ranges between setpoints “MS79” and “MS79-MS91”, the thermoregulation system calculates an increase in the capacity demand at a manufacturer-set percentage only if the capacity demand is greater than 0%, otherwise the increase will be 0%. It must be set up according to the system requirements.	MS68

The parameters listed below too are part of the MS – Multilogic parameter group. These parameters are generally set by the manufacturer during the FAT process, based on the configuration, number and type of units contemplated in the order. Inn other words, they do not normally require editing even if they are at “service” level.

All the priorities of the Slave units are set to 1 (highest priority) by the manufacturer.

5.3.6 MS – Multilogic parameters - Additional parameters

Change to be made in	Parameter	Description / Additional notes	MS Std
Master	MS1	*Delay in Slave failed alignment (AL15) upon mode switching* Range: 0 .. 999 minutes MS1 indicates the delay time in identifying that the Master unit is not aligned with one Slave unit, in other words the status of a Slave unit is not compatible with the Master unit (e.g. a Slave has been switched to OFF from the keyboard).	MS1
Master	MS5	*Master Priority* Range: 1 .. 9 MS5 defines the priority level of the Master unit. Level 1 is the highest priority level (major priority) and level 9 is the lowest. **“MS5” must be set to 1.**	MS5
Master	MS6	*Unit selection mode* 0 – Fixed 1 – FIFO (not available on multi-purpose units) 2 – Based on hours 3 – Based on starts This parameter defines the way by which the Master unit establishes the switch-on and switch-off sequence of multi-purpose units networked in the Multilogic system. Default **“MS6 = 2 – Based on hours”**.	---
Master	MS7	*Multilogic capacity distribution mode* 0 - Balanced 1 - Saturation 2 - Optimised **MS7 is a manufacturer parameter** and it indicates the capacity distribution mode of the Multilogic system. **“MS7 = 2 – Optimized”**	MS6
Master	MS43	*“Optimized” capacity distribution - Percentage capacity steps after step MS44* Range: 0 .. 100%. **This is a manufacturer parameter** intended to define the saturation threshold required to move on to the other units when capacity distribution is in optimized mode. It is used in the steps following step one and it **is set at 25%**.	MS43

Change to be made in	Parameter	Description / Additional notes	MS Std
Master	MS44	*“Optimized” capacity distribution - First capacity step percentage* Range: 0 .. 100% **This is a manufacturer parameter** intended to define the first saturation threshold required to move on to the other units when capacity distribution is in optimized mode. It is used in the step one and it **is set at 50%**.	MS44
Master	MS45	*Master / Slave communication timeout* Range: 0 .. 999 seconds MS45 is the delay time that the Master uses to define communication missing between the Master and a Slave unit.	MS45
All units	MS46	*Master / Slave offline alarm. Activation delay* Range: 0 .. 999 seconds This parameter defines the delay time elapsing between missing communication between the Master and a Slave unit and alarm displaying.	MS46
Master	MS50	*Min. setpoint in cold circuit operation* Range: -50 °C .. MS51 This is the min. value of the Multilogic setpoint in chiller mode.	MS50
Master	MS51	*Max. setpoint in cold circuit operation* Range: MS50 .. 110 °C This is the max. value of the Multilogic setpoint in chiller mode.	MS51
Master	MS59	*Cold side - With NZ or PID - Max. activation time* Range: MS60 .. 999 seconds This is the max. time interval to increase the percentage capacity demand when the reference water temperature exceeds “MS49+MS67”.	MS59
Master	MS60	*Cold side - With NZ or PID - Min. activation time* Range: 0 .. MS59 seconds This is the min. time interval to increase the percentage capacity demand when the reference water temperature exceeds “MS49+MS67+MS55”.	MS60
Master	MS61	*Cold side - With NZ or PID - Max. de-activation time* Range: MS62 .. 999 seconds This is the max. time interval to reduce the percentage capacity demand when the reference water temperature is below the setpoint stored in “MS49”.	MS61
Master	MS62	*Cold side - With NZ or PID - Min. de-activation time* Range: 0 .. MS62 seconds This is the min. time interval to reduce the percentage capacity demand when the reference water temperature is below “MS49-MS57”.	MS62
Master	MS70	*Enable booster function* 0 – No. 1 – Yes. **This is a manufacturer parameter** used to enable or disable the booster function by which the Master unit “switches on” the backup units if the measured system temperature achieves extremely high values on the cold side or extremely low values on the hot side. **The booster function is disabled by the manufacturer**.	MS70
Master	MS74	*Cold side – Set booster* Range: 10 .. 110 °C MS74 sets the max. temperature limit value on the cold side beyond which the Master unit causes the backup units to get started, after the time set in MS76 has elapsed, in order to fulfil the capacity demand in chiller mode.	MS74
Master	MS75	*Cold side – Booster differential* Range: 0,1 .. 25,5 °C This value is used to calculate the temperature threshold (MS74 – MS75) on the cold side below which the Master unit switches off the backup units again.	MS75

Change to be made in	Parameter	Description / Additional notes	MS Std
Master	MS76	*Delay in booster activation* Range: 0 .. 99 minutes MS76 is the delay time the Master unit waits before enabling the backup units when the value of the reference temperature is such as to require booster activation in either chiller or heat pump mode.	MS76
Master	MS79	*Hot side – Set booster* Range: 0 .. 70 °C This value sets the min. temperature limit value below which the Master unit causes the backup units to get started, after the time set in MS76 has elapsed, in order to fulfil the capacity demand in heat pump mode.	MS78
Master	MS80	*Hot side – Booster differential* Range: 0,1 .. 25,5 °C This value is used to calculate the temperature threshold (MS79 + MS80) above which the Master unit switches off the backup units again.	MS79
Master	MS83	*Hot side - Min. setpoint* Range: 50 °C .. MS84 This is the min. value of the Multilogic setpoint in heat pump mode.	MS53
Master	MS84	*Hot side - Max. setpoint* Range: MS83 .. 110 °C This is the max. value of the Multilogic setpoint in heat pump mode.	MS54
Master	MS87	*Hot side - With NZ or PID - Max. activation time* Range: MS88 .. 999 seconds This is the max. time interval to increase the percentage capacity demand when the reference water temperature is inferior to the value resulting from “MS52-MS68”.	MS63
Master	MS88	*Hot side - With NZ or PID - Min. activation time* Range: 0 .. MS87 seconds This is the min. time interval to increase the percentage capacity demand when the reference water temperature is below “MS52-MS68-MS56”.	MS64
Master	MS89	*Hot side - With NZ or PID - Max. de-activation time* Range: MS90 .. 999 seconds This is the max. time interval to reduce the percentage capacity demand when the reference water temperature exceeds the setpoint stored in “MS52”.	MS65
Master	MS90	*Hot side - With NZ or PID - Min. de-activation time* Range: 0 .. MS89 seconds This is the min. time interval to reduce the percentage capacity demand when the reference water temperature exceeds the value resulting from “MS52+MS58”.	MS66
Master	MS96	*With NZ or PID – Frequency of compressor switch-on in neutral zone* Range 0 .. 99 minutes This is the time interval defining the increase, if any, in the number of compressors ON when the temperature is within the neutral zone and the demand is already above zero.	---

5.4 Multilogic - Multi-purpose units: implementation of MASTER/SLAVE communication network

With the Multilogic system, the units must be connected in an Ethernet network. The units are connected and their address defined as illustrated for the connection and addressing procedures of standard Multilogic systems. The lower IP address must be associated to the Master unit.

Further information on how to change the IP address may be found in the relevant parts of the section concerning a standard Multilogic network.

5.5 Multilogic - Multi-purpose units: main parameters

The same rules applicable to the parameters of a standard Multilogic network are also valid for multi-purpose units, especially with reference to the sequence of the IP addresses and serial SP12 addresses. The units are normally shipped from the factory with the setting of default parameters for "stand-alone" operation. Enabling for networked operation and configuration for the required operating mode must be done by service personnel.

The lowest serial address at parameter SP12 must be assigned to the Master unit and those of the Slave units must be consecutive to it. The sequence of the serial addresses set in the units must match the sequence of IP addresses.

“Gaps” must also be prevented, in other words the values of the serial addresses must be subsequent.

The main parameters involved, with regard to the Master unit, are shown in the table below. Needless to say, the number of units to be set matches the number of units connected to the Multilogic network. For the Master unit, it is essential to set parameter “MS2” consistently with the network to be created. “MS2” must be set to 3 when the network includes 1 Master unit and 2 Slave units.

Master

Parameter	Value	UM	Description
CF11	1	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP12	1	-	BMS serial address
MS2	3	-	Number of units inside the system (including Master)

Slave 1

Parameter	Value	UM	Description
CF11	2	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP12	2	-	BMS serial address

Slave 2

Parameter	Value	UM	Description
CF11	2	-	Network configuration (0 = Stand-alone; 1 = Master; 2 = Slave)
SP12	3	-	BMS serial address

5.6 Multilogic - Multi-purpose units: priority levels

The function of priority levels is the same in both standard Multilogic networks and those consisting of multi-purpose units. In the latter case, the manufacturer sets the level in all units to “1” as they are all multi-purpose units: as such, the operating modes are multiple and the ultimate goal is to meet the demand **selecting water/water mode as the preferential mode**, which is fulfilled at best using the highest priority level possible (1) for all the units.

Further information on the meaning of “priority” may be found in the relevant parts of the section concerning a standard Multilogic network.

To summarise, the example below shows a case with three units connected to the Master.

Parameter	Value	UM	Description
MS5	1	-	Master priority
MS11	1	-	Slave 1 priority
MS12	1	-	Slave 2 priority

5.7 Multilogic - multi-purpose units: capacity management

Whenever the possibility is evaluated with the manufacturer to set different priorities for the units connected to one Multilogic network, units having higher priority are enabled first.

The manufacturer normally sets the Multilogic network featuring multi-purpose units for "optimized" activation mode in manufacturer parameter "MS7". It normally works as explained below.

- Units with the same priority are started up one at a time. The request for activation moves on to the next unit when the previous one has reached the predefined request percentages (manufacturer parameters MS43 and MS44).

Other modes may be considered prior analysis and verification with the manufacturer, as briefly illustrated below:

- "Saturation" - Units are activated one at a time and the switch-on request is output to the next unit only when the previous one is at 100%.
- "Balancing" - all units with the same priority increase the capacity in parallel, so favouring operation at partial loads.

The switch-on/switch-off criterion of one unit compared to another is the number of hours of operation, if the units have the same priority.

The parameter values are set by the manufacturer.

Parameter	Value	UM	Description
MS6	2	-	Unit selection mode: 0 = Fixed (no rotation); 1 = FIFO (not enabled); 2 = Based on hours **(mandatory)**; 3 = Based on starts
MS7	2	-	Multilogic capacity distribution procedure (2 = Optimized, **set by manufacturer**)
MS43	25	%	"Optimized" capacity distribution – Percentage of capacity steps after step MS44 Set by manufacturer
MS44	50	%	"Optimized" capacity distribution – First capacity step percentage Set by manufacturer

Parameter MS7 selects the same capacity management logic for both the cold and the hot side.

5.8 Multilogic - Multi-purpose units: thermoregulation

The controller of the Multilogic function uses a thermoregulation algorithm to adjust to the system demand the capacity provided by the Multilogic network.

As explained above, the parameters used to calculate the activation and de-activation times are preset by the manufacturer during the FAT process. The other parameters involved are shown in the table below. The values of the parameters are representative. In specific cases, different values can be set.

Please not that the thermoregulation algorithm uses the outlet probes on both the hot and the cold side as reference probes. No other adjustment is required at service level.

Master

Parameter	Value	UM	Description
MS49	7.0	°C	Cold side - Setpoint
MS55	5.0	°C	Cold side - With NZ or PID - Activation zone offset
MS57	2.0	°C	Cold side - With NZ or PID - De-activation zone offset
MS67	1.0	°C	Cold side - With NZ or PID - Band
MS82	45.0	°C	Hot side – Setpoint
MS85	5.0	°C	Hot side – With NZ or PID – Activation zone offset
MS86	2.0	°C	Hot side – With ZN or PID – De-activation zone offset
MS91	1.0	°C	Hot side – With NZ or PID – Band

Parameters MS49, MS50 and MS51 must always be aligned with parameters ST1, ST2 and ST3, and parameters MS82, MS83 and MS84 must always be aligned with parameters STH4, STH5 and STH6.

Moreover, to have a good behavior of the plant in offline condition, it is advisable to set in standalone mode the Neutral Zone and PID control based on the outlet temperature probe for each unit.

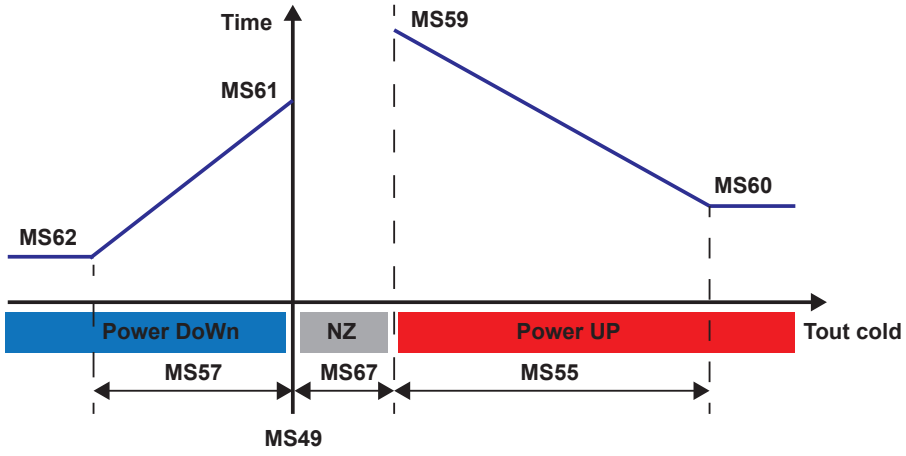


Fig. 49 Cold side operation

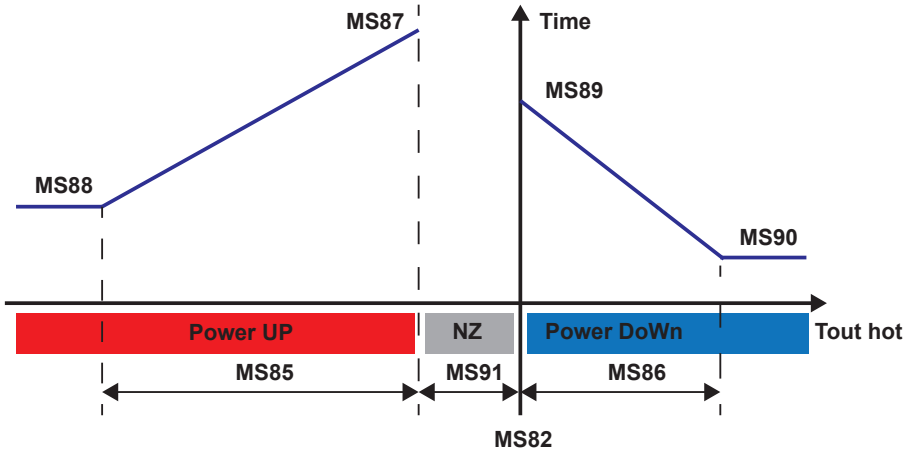


Fig. 50 Hot side operation

The abbreviations in the graphs are:

- power UP = capacity increase;
- power DoWn = capacity decrease;
- NZ = neutral zone
- Tout cold = outlet water temperature from system on cold side.
- Tout hot = outlet water temperature from system on hot side.

As a general rule, both for the hot and the cold side, the greater the “distance” of the “Tout” temperature from the setpoint, the more frequent the increase/decrease is.

The thermoregulation algorithm either increases or reduces the demand at predefined time steps, as shown in the graphs above, based on the water temperature “Tout” detected by the probe at the outlet of the system. The percentage demand increase/decrease **is set by the manufacturer** and is the same on the cold and hot sides. The required capacity value calculated in this way gives an indication of the capacity to be distributed to the various units, according to the logic defined in parameter “MS7”. The calculation algorithm in use is the same as for a Multilogic connection with standard units and on both the cold and the hot side.

Further information may be found in the relevant parts of the section concerning a standard Multilogic network.

5.9 Multilogic - Multi-purpose units: backup function and unit rotation

In the Multilogic function, the application allows one or more units of the system to be managed in Back-up function.

Master

Parameter	Value	UM	Description
MS69	0	-	Number of backup units

The number of Back-up units should be set in parameter MS69. The backup units are managed in the same way as in a standard Multilogic network.

The opportunity is offered to enable rotation between units in operation and backup units. Please note that rotation only occurs between units have the same priority level as those in operation. Rotation is only implemented:

- Rotation based on the number of hours of operation

Master

Parameter	Value	UM	Description
MS6	2	-	Unit selection mode
MS71	8	hr	Rotation time of units

Rotation is disabled when MS71 = 0.

All instructions and warnings given for a standard Multilogic network apply to multi-purpose unit rotation based on the number of hours of operation. If the units connected in the Multilogic network stay ON continuously for the time set in parameter “MS71”, the Master unit checks the hours of operation of the units and calculates again the switch-on sequence. Rotation takes place if the new switch-on sequence requires the backup unit to be switched on. The Master disables one unit that is running and enables one of the backup units, keeping the delivered capacity in line with the capacity demand.

Rotation is also possible at every switch-on, i.e. whenever the Multilogic function switches from capacity demand at 0% to a capacity condition exceeding 0%. This is due to the fact that the Master unit switches on the units following the switch-on sequence that it has recalculated and is valid at the current time.

5.10 Multilogic - multi-purpose units: booster function

The Booster function activates the Back-up units when those that are running are unable to meet the capacity demand of the system. The booster function is only enabled if the number of backup units is **greater than 0**: capacity management is type “MS7 = 2 – optimized” and “MS70 = 1”. When the temperature value is such that the booster function is disabled, the number of backup units is restored.

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

Parameter	Value	UM	Description
MS70	0	-	Enables Booster function (0 = No; 1 = Yes)
MS74	25.0	°C	Cold side – Setpoint in booster
MS75	5.0	°C	Cold side – Differential in booster
MS76	15	min	Booster activation delay
MS79	25.0	°C	Hot side – Setpoint in booster
MS80	5.0	°C	Hot side – Differential in booster

The booster function operates in the same way as in a standard Multilogic network, the only difference being that it can be enabled on both the cold and the hot side independently, based on the temperatures measured by the corresponding control probes. It may be active simultaneously on both sides.

Parameter “MS70” in multi-purpose units is a manufacturer parameter and the booster function is disabled by default.

If the booster function is enabled by the manufacturer based on specific requirements, the graph showing operation on the cold and hot sides is the same as for a Multilogic system in chiller/heat pump mode. **The capacity received on the cold and the hot side by the backup units that have been activated is equal to 100%.**

If the booster is activated with a request not at 100%, the backup units follow the setting set in MS7.

5.10.1 Hot side

After the booster function is selected (“MS70 = 1”), it gets enabled as soon as the reference water temperature is lower than the setpoint stored in parameter “MS79” for a longer time than set in parameter “MS76”; it gets disabled automatically as soon as the reference water temperature rises above the activation value plus the corresponding differential, which is set in parameter “MS79+MS80”.

5.10.2 Cold side

After the booster function is selected (“MS70 = 1”), it gets enabled as soon as the reference water temperature exceeds the setpoint stored in parameter “MS74” for a longer time than set in parameter “MS76”; it gets disabled automatically as soon as the reference water temperature drops below the activation value minus the corresponding differential, which is set in parameter “MS74-MS75”.

Activation of the booster function, which causes a rotation, may result in the cancellation of the next rotation.

5.11 Multilogic - multi-purpose units: water circulation in user system

The Multilogic system uses the outlet water probe as control probe. This is why it is important to have a min. water flow in every condition.

The parameters involved are shown in the table.

For all units

Parameter	Value	UM	Description
PA1	2	-	Cold side – Pump management (0 - Not managed; 1 - Continuous operation; 2 - Compressor-dependant operation)
PA24	2	--	Hot side – Pump management (0 - Not managed; 1 - Continuous operation; 2 - Compressor-dependant operation)

All units interconnected in the Multilogic system **must have "PA1 = 2 – Compressor-dependant operation"** and "PA24 = 2 – compressor-dependant operation". This value is used by the Master unit to manage the water pumps even in cases when the compressors are disabled so as to correctly measure the outlet temperature on the cold and hot sides, which helps manage the switch-on of one pump in the system on each side following a dedicated algorithm.

When the capacity demand on either the cold or hot side is greater than zero, water is made to circulate according to the thermoregulation demand, and the Master unit manages pump switch-on in connection with the units whose compressors are on.

5.12 Multilogic - multi-purpose units: special conditions

During system operation, in addition to those examined above, special conditions may occur that have to do with system management.

5.12.1 No communication

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

All units

Parameter	Value	UM	Description
MS4	1	-	Unit operation with offline alarm: Master (0 = Switch-off; 1 = Standalone)

The behaviour of the Master unit in cases when it does not receive any reply from the Slave units in the Multilogic network is determined by the value of parameter "MS4":

- if "MS4 = 1 - Standalone", the unit starts operating as if it was "alone", i.e. the only unit in the system; in this case, the control probes, setpoints and control procedures are the local ones, as defined in parameters ST as regards thermoregulation and PA as regards pumps;
- if MS4 = 0 - Switch-off, as soon as the unit goes offline (one Slave unit fails to communicate with the Master or the Master stops communications with all Slave units), the unit switches off.

5.12.2 Unit connection to network during system operation

A Multilogic network including multi-purpose units behaves like a standard Multilogic network even when one unit is made available while the system is in operation.

When this condition occurs, the Master recalculates the system demand and distributes the capacity to the units available at that time, according to the enabled operation logics. In this case, the Master unit introduces a delay time ("MS72") between the re-calculation of the capacity demand and the activation of one unit.

Further information may be found in the relevant parts of the section concerning a standard Multilogic network.

5.13 Multilogic - Multi-purpose units: types of system units with dedicated pumps

Some examples of Multilogic connections with multi-purpose units are illustrated below. This example consists in an outline diagram which illustrates how the Multilogic function works and includes the min. requirements for correct system operation.

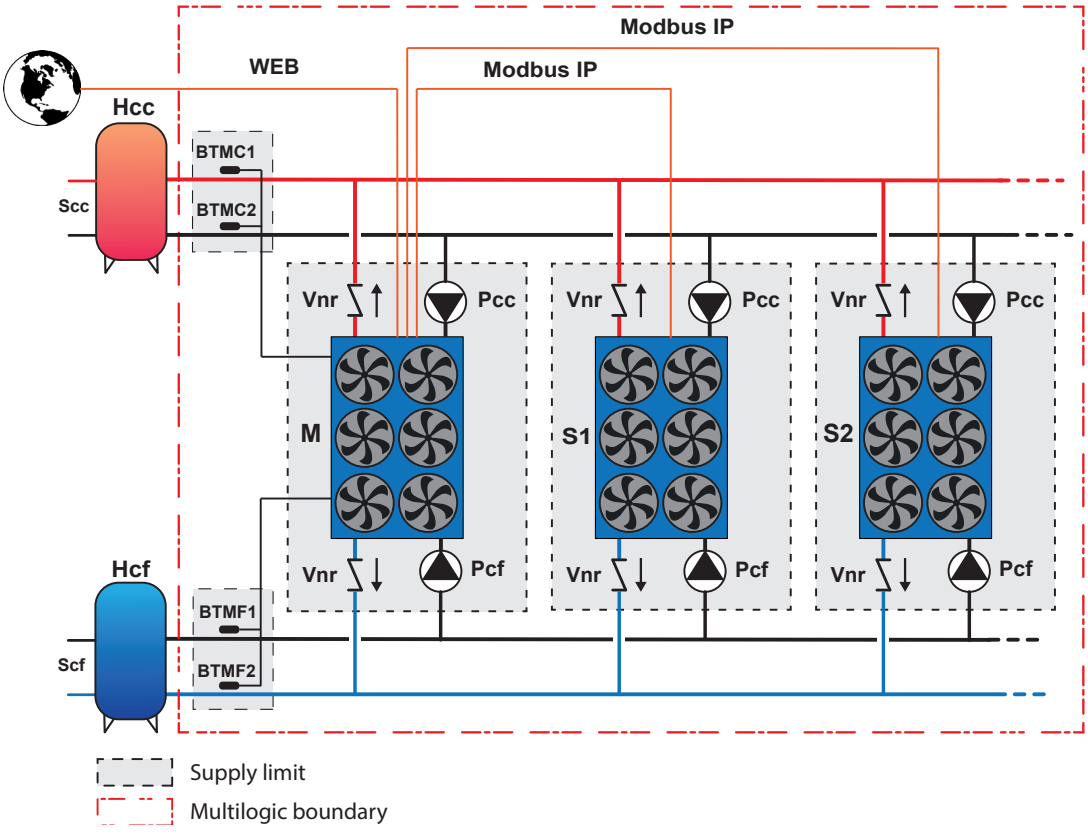
Pcc and Pcf pumps are mounted on every single unit although the system actually operates at variable flow rate as the number of active pumps is variable and depends on the thermal load (“PA1=2” and “PA24=2” on units connected to the Multilogic network).

Information provided above concerning the Flowzer VP (Adjustable pump speed) and Flowzer VDE (Constant water flow control inverter pump) options in a standard Multilogic system also applies to 4-tube multi-purpose units.

The diagram below shows the pump “outside the unit”: both configurations are possible - with pump installed onboard or outside the unit. In both cases, the pump **must** be controlled directly by the unit for the type of system specified.

The following acronyms are used in the diagram:

- M = Master unit
- S1, S2 = Slave unit
- BTMC2 = common temperature probe on return line of hot side in Multilogic system;
- BTMC1 = common temperature probe on delivery line of hot side in Multilogic system;
- BTMF2 = common temperature probe on delivery line of cold side in Multilogic system;
- BTMF1 = common temperature probe on return line of cold side in Multilogic system;
- Hcc = hydraulic circuit breaker or manifold of the hot circuit;
- Hcf = hydraulic circuit breaker or manifold of the cold circuit;
- Scc = hot secondary circuit;
- Scf = cold secondary circuit;
- Vnr = non-return valve
- Pcc = unit water pump of hot circuit;
- Pcf = unit water pump of cold circuit.



The yellow line defines the area of action of the Multilogic management function. In addition to the water probes installed on each individual unit, probes “BTMC1”, “BTMC2”, “BTMF1” and “BTMF2”, which are specifically designed for the Multilogic function, are wired in the factory on the Master controller. The system may be connected to an external BMS for remote monitoring. A network switch is fitted inside the Master unit to physically implement the connection between the units.

Check valves “Vnr” and any other options for the hydraulic system, such as, but not limited to, probe pockets, are not fitted in the unit and their installation at the right point in the system falls under the responsibility of the client/installer.

The manufacturer should be contacted if the system in question is different from the systems described above.

The installer must implement the system in compliance with the existing regulations at both national and local level.

5.13.1 Instructions for correct system operation

The installer should make sure that, but not limited to it:

- install a check valve at the user-side outlet of each unit to prevent water recirculation when the pump of the unit is not running; this applies to both the cold and hot sides; if the installation includes an external centralized pumping system, the check valves at the unit outlet **are not required**: recycling is avoided and the water valve is fully closed;
- correctly install sensors BTMC1, BTMC2, BTMF1 and BTMF2 of the Master unit (in the common sections of the system); suitable pockets (correct length and diameter) are used for the featured probes so that each probe is correctly fitted “in the water flow” and an appropriate heat conducting paste is used to enhance the reading accuracy of the probe;
- the installer must ensure the correct min. flow rate to the heat exchangers of each unit on both the cold and hot sides to be checked under all operating conditions;
- the external pumps or the water on/off valves for each individual unit are fitted;
- suitable water filters need to be installed in the system;
- the system needs to be implemented in compliance with good installation practices and **the existing regulations** (by way of exemplification, but not limited to it, through the installation of expansion joints, where required, air vents at the highest points of the system, safety valves, expansion vessels, etc.).

Although the system diagrams are functional diagrams, they show the correct locations of devices (probes, non-return valves, etc.) to the system.

5.14 Multilogic - multi-purpose units: description of display pages

All information regarding the Multilogic function is given in specific pages.

A click on the “Multilogic” button on the main page gives access to the screens dedicated to this function.

5.14.1 Master unit pages

The main page is the same for both the Master and the Slave units, but some of the displayed parameters take on a different meaning.

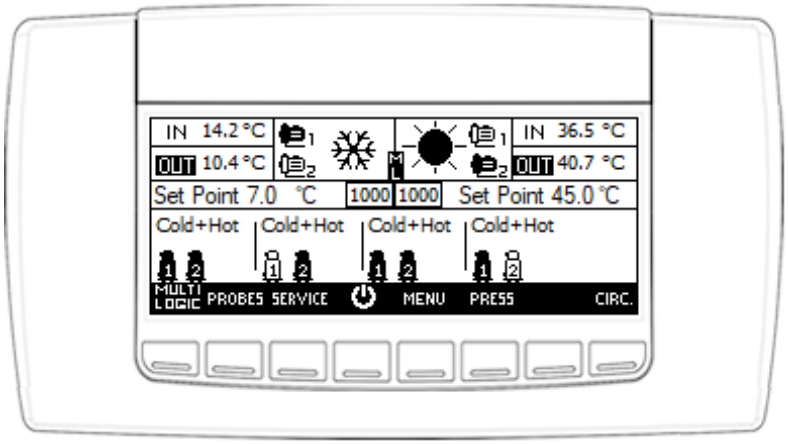


Fig. 51 Main screen of a multi-purpose unit regarding the Multilogic function

The acronym **ML** on the main page appears at the centre of the display if the units are online.

In the Master unit, the capacity demands for the cold/hot sides depend on the following:

- Master online: demands 0 .. 1000 indicate the total demand generated by the Master unit based on the measurements of the system probes;
- Master offline and operating in standalone mode: in this case demands 0 .. 1000 are the local capacity, based on the measurements of the local probes.

The specified setpoints are local setpoints.

A click on the “Multilogic” button on the main page gives access to the pages of the “Multilogic” function.

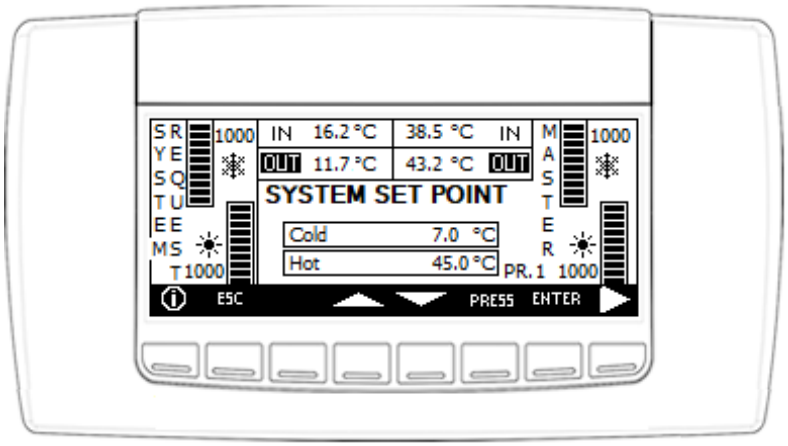


Fig. 52 Main screen of the Master regarding the Multilogic function

The system setpoints for the cold and hot sides are displayed in the central area.

The system inlet and outlet temperatures referred to both sides are shown in the top central area - the temperature on the left is for the cold side (BTMF1 and BTMF2 in previous diagrams) and that on the right is for the hot side (BTMC2 and BTMC1 in previous diagrams).

The highlighted term“**OUT**” indicates that the control is on the outlet temperature.

The left-hand side shows both demands from the entire system (cold and hot sides) where 0 = no demand and 1000 = total capacity the Multilogic system can deliver; the right-hand side shows the priority of the Master unit, which is set to 1, and the percentage capacity requested from the Master unit, considering that 1000 means that the Master unit is delivering its full capacity in this case.

The setpoint values can be changed using the “arrow up” and “arrow down” buttons. After changing a value, it must be confirmed pressing the “Enter” button.

A click on the “Esc” button gives access to the main screen.

A click on the “arrow rh” button gives access to the page showing the way in which the capacity generated by the Master is shared with the other Slave units, broken down between cold and hot side.

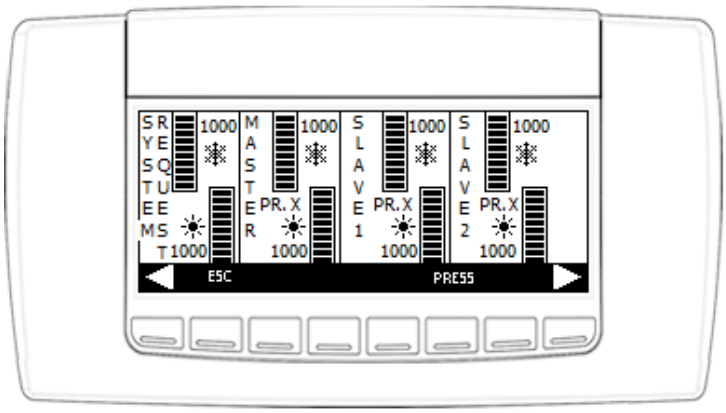


Fig. 53 Main Master screen with capacity distribution

The area on the left shows the capacity on the system cold side and on the hot side. Moving from left to right, the page shows the Master first, followed by Slave 1 and Slave 2. For each unit on screen, the capacity required by the system is broken down between hot side (bottom) and cold side (top). The set priority level is displayed at the centre (e.g. PR X).

A new click on the “arrow rh” button gives access to the next page where it is possible to view the capacity distribution of the next Slave units featured in the system and their priority. Moving on, the values of the other units are displayed, if any.

A click on the “arrow lh” button gives access to the previous page.

A click on the “Esc” button gives access to the main screen.

5.14.2 Pages of the Slave units

The main page of a Slave unit is equal to the pages of the Master, although the differences illustrated below apply.

The acronym **ML** on the main page appears at the centre of the display if the units are online.

The left side of the page shows the mechanical capacity required from the Slave unit by the Master and the priority of the Slave unit.

In the Slave unit, the capacity demands for the cold/hot sides depend on the following:

- Slave online: demands 0 .. 1000 are demands that the Master sends to the Slave unit, based on the measurement of the system probes;
- Slave offline and operating in standalone mode: demands 0 .. 1000 are the local capacity, based on the measurements of the local probes.

The specified setpoints are local setpoints.

A click on the “Multilogic” button on the main page gives access to the pages of the “Multilogic” function.

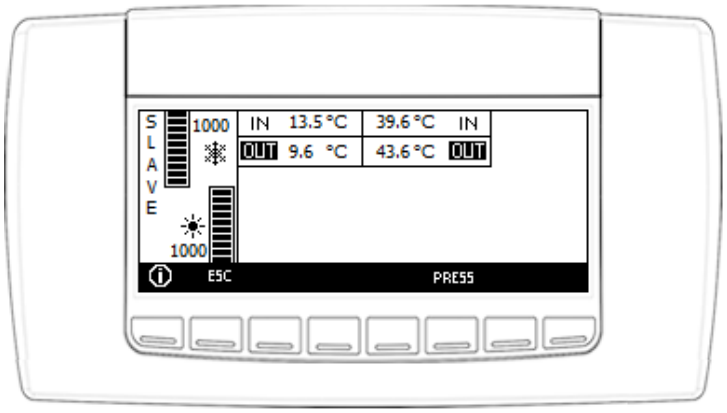


Fig. 54 Screen of the Slave units regarding the Multilogic function

In the Slave units, there is just one page for viewing information regarding the slave unit.

The left side of the page shows the capacity that the Master unit requires from the Slave unit. The top central part displays the water temperature values measured at the system inlet and outlet, as well as any active alarms.

If the Slave unit is offline, a window appears at the centre of the display with the relevant message.

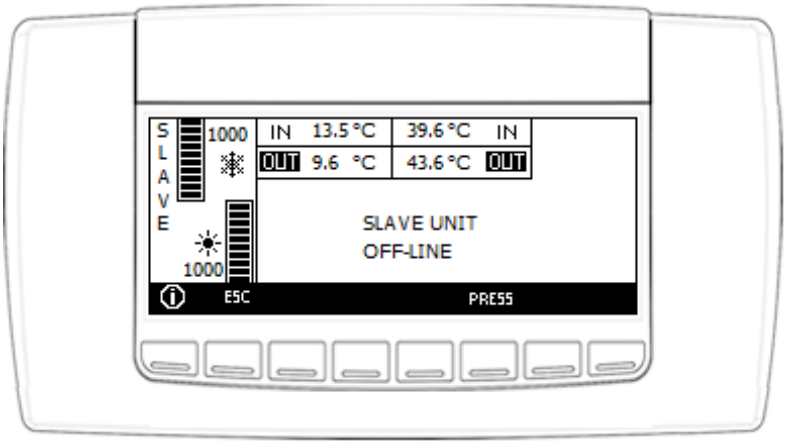


Fig. 55 Screen of offline Slave units relating to the Multilogic function

A click on the “Esc” button gives access to the main screen.

5.15 Multilogic: alarms

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.

AL15	**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

AL16	**Communication error between units**
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.

AL92	**Hot circuit inlet temperature probe alarm**
AL93	**Hot circuit outlet temperature probe alarm**
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**
Hot circuit	The circuit operates in standalone mode.
Cold circuit	It follows its own setpoints.

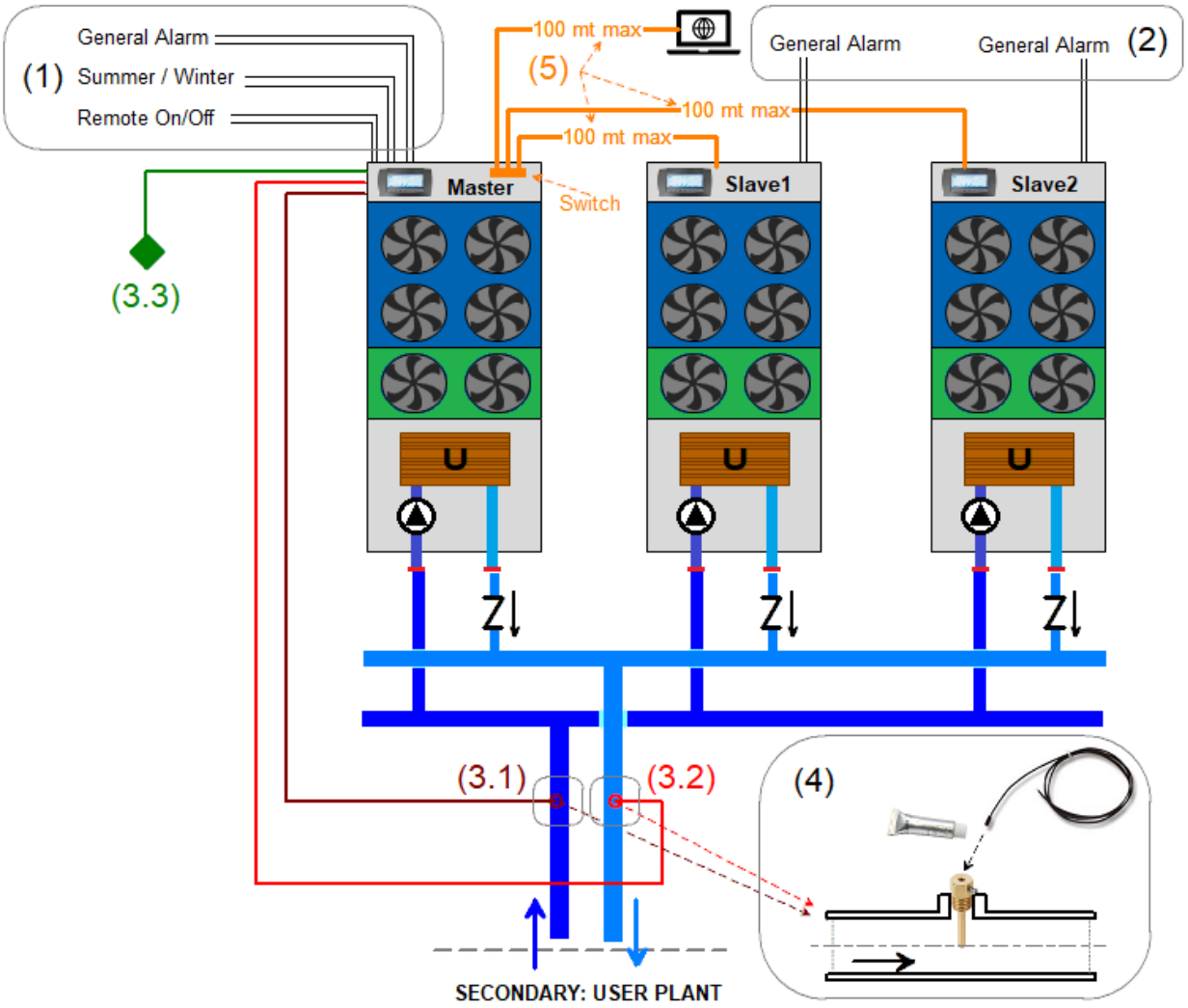
AL549	**Cold circuit inlet temperature probe alarm**
AL550	**Cold circuit outlet temperature probe alarm**
Reason for activation	When the value measured by the analogue input is outside the set operating range.
Reset	When the value measured by the analogue input falls within the set operating range.
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Hot circuit	It follows its own setpoints.
Cold circuit	The circuit operates in standalone mode.

ACF13	**Multilogic network configuration alarm**
Reason for activation	It is displayed in the Master when the priority level is not assigned correctly to the networked units.
Reset	When the priority level is assigned correctly to the units of the network
Reset mode	Automatic
Alarm icon	Flashing
AlarmLog	Yes
Alarm relay	Yes
Devices	**Behaviour in the event of an alarm**
Unit	Maintains the "OFF" state that should have been set before modifying the "MS" parameters
The other devices	They follow their control

6 MANUFACTURER SETTINGS FOR UNITS WITH MULTILOGIC/MULTIFREE OPTION

If not otherwise specified or agreed at the negotiation stage and inside the order confirmation, the units will be set as a stand alone; CF11 = 0 and SP12 = 1 for the Master, CF11 = 0 and SP12 = “1 + n” for the Slave “n”. The IP addresses are set at 10.2.3.20 for the Master and 10.2.3.”20+n” for the Salve “n”, in according with the serial addresses SP12.

Before connecting the Multilogic/Mulitfree system, it is essential to ensure that the units have been installed as set out in the “Installation, Operating and Maintenance” manual. In particular, in the case of water/water freecooling no glycol units, the dry cooler connections must be complete.



Section (1): optional basic connection to the Master unit (example for CH&CH-FC or CH&HP): for every supply must be checked the possible connections to the Master in according with the unit type. For example, if there are multi-purpose 4-pipes units, to the Master is possible to connect the remote ON/OFF for the hot and cold side as well.

Section (2): optional connection to the Slave units (general alarm outputs only).

Section (3): right probe position in the common parts of the plant, placed inside the probe pockets **(at installer charge)**.

- Multilogic with CH&HP: (3.1) common inlet and (3.2) common outlet water plant temperature probes.
- Multifree Air/Water and Water/Water units: (3.3) outside air temperature probe in addition to the Master.

- Multifree Water/Water FCNG units, in addition to the previous probes (not in the above example):
  - Master: two dry-cooler side probes, installed in the probe pockets in the common plant dry-cooler pipes.
  - Slave (all): the dry-cooler outlet water temperature probe is already installed inside the hydraulic module; the dry-cooler inlet water temperature probe must be correctly installed on site in according with the Slave hydraulic drawings. Additional outside air temperature probes must be installed too.
  - Dry-coolers mixer signal board for the common signal to the dry-coolers' fans (additional board).
- Multilogic with Multi-purpose 4 pipes units (not in the above example):
  - Master: 2 common probes hot side and 2 common probes cold side installed inside the probe pockets.

Section (4): probe installation example, with sleeve brazed on the pipe, probe pocket with suitable length and diameter, heat conductive paste before insert the probe.

Section (5): Ethernet connection with UTP CAT5e patch cable type, RJ45 connectors and max. distance 100 meters.

6.1 Options: probes

The control probes of the Multilogic system are delivered together with the Master unit. They are located in the electrical cabinet and they are wired to the controller. **The client/installer is responsible for fitting and assembling the probes on the delivery and return branches of the hydraulic system**, as specified in the aforementioned examples.

The temperature probes must be installed in dedicated probe pockets.

The length of the cable in the standard probes installed (12 meters) may not be enough. The cable of the temperature probes in the Master unit can be extended following the instructions below. After cable extension, a check must be performed that the probe can correctly read the temperature.

Please pay attention to the following:

- when the distance between the Master unit and the pockets is **inferior** to 60 m, the probe may be extended using a twisted and shielded cable with a cross-section higher than/equal to 2x1 mm^2 (the shielding must be earthed **on one side only**);
- when the distance is **above** 60 m, the manufacturer must be contacted.

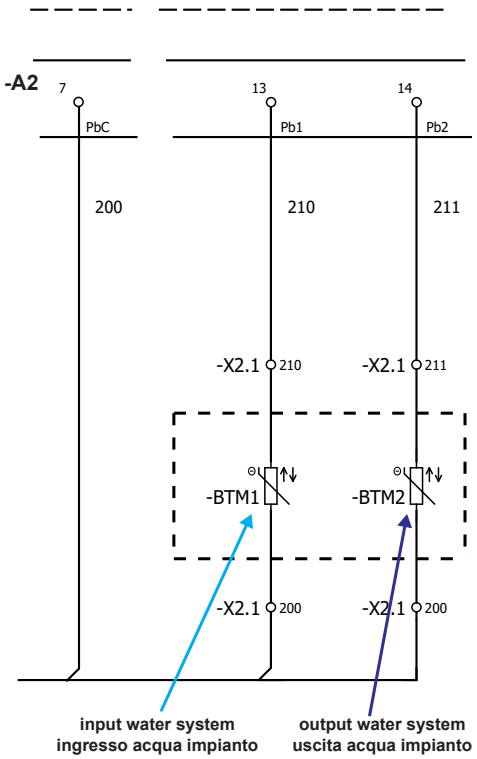


Fig. 56 Multilogic probes on CH or HP, air/water Master unit

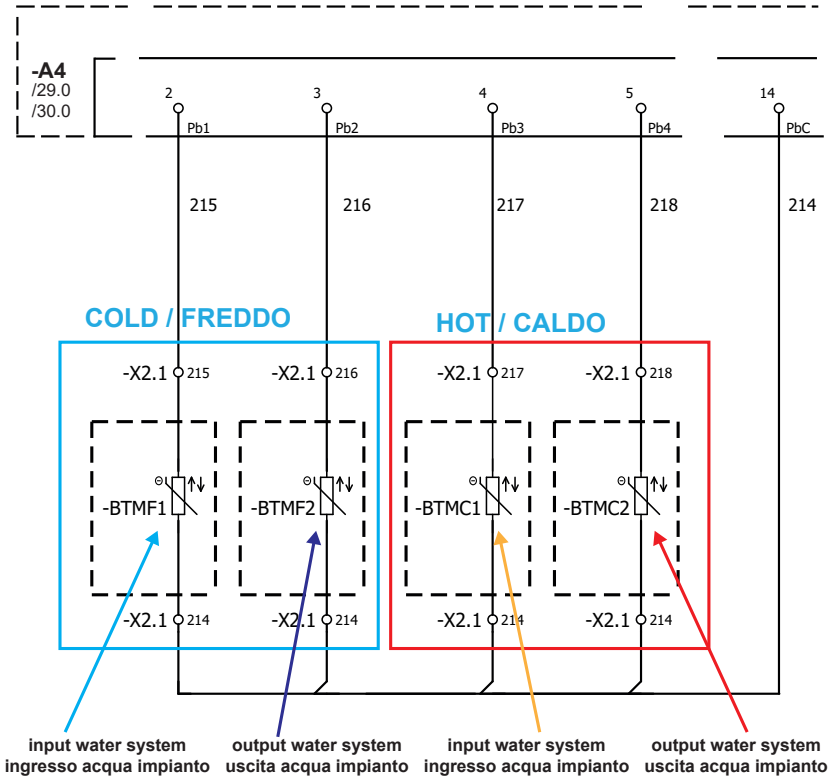


Fig. 57 Multilogic probes on Master with multi-purpose units

If not otherwise specified, the probes in use are NTC probes, 6 mm in outer diameter.

Another important check is that the reading provided by the probe is not only accurate, but also consistent with the function of the probe in order to prevent incorrect probe positioning. Needless to say, the water flow must be correct.

In Multifree systems, check that the probe(s) reading the outside temperature is(are) positioned in such way as to give a correct reading of the outside air temperature. These probes must be installed in the shade or in such way that they are not exposed to direct sunlight or facing north to prevent the measurement from being affected.

6.2 Options: probe pockets

Probe pockets must be installed in the system in the common sections of the Multilogic system, as shown in the hydraulic diagram of the unit. Suitable diameter female sleeves must be welded, based on the diameter of the pockets to be installed (both sleeves and pockets are outside the scope of our supply).

The following arrangements are necessary:

- install the sleeves so that the pockets and the probes are in a vertical position and not exposed to accidental damage;
- secure the pockets to the sleeves using a special sealant to make them leak tight;
- make sure that the pockets are of suitable length, based on the diameter of the system water pipe;
- make sure that the pockets have a suitable diameter with the probe type in use so that the probe can deliver the most accurate reading possible after installation.
- Pockets of incorrect length (too short or too long) or having an excessively large diameter may cause the probes to give incorrect readings. If the diameter is too narrow, the probe may not fit correctly or fully. In both cases, reading errors may be experienced;
- fill the pockets with heat conducting paste before inserting the sensor in order to ensure correct temperature reading;
- secure the cables properly after completing the thermal insulation of the hydraulic circuit;
- make sure that, after installation, the sensors are protected from accidental damage and that the connection cables are secured properly.

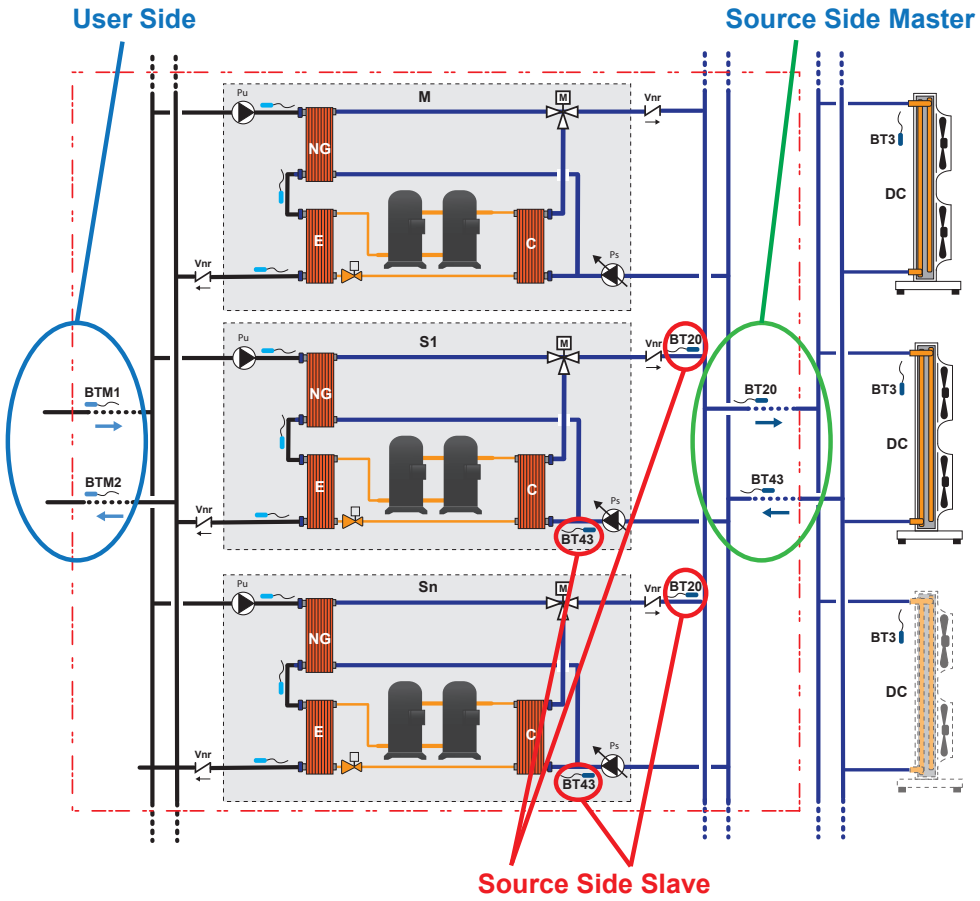


Fig. 58 Position of system probes: example of Multilogic / Multifree system, water/water, no glycol

If the system to be implemented is not contemplated in the diagrams above, the manufacturer should be contacted to clear out doubts on the correct position of both pockets and probes.

6.3 Options: Ethernet switch

The Ethernet switch is fitted inside the electrical cabinet of the Master unit.

The following connection arrangements are necessary:

- the connection between the Master and the Slave units is implemented using a cable that must at least be type **UTP CAT5e** or higher (straight or **patch type**, no “cross” type), with RJ45 connectors. The max. length of the cable between the Master unit and one Slave unit must be 100 metres;
- the switch type depends on the selected option (2, 4, 6 ports);
- the client/installer is responsible for the connections from the Master to the Slave units.

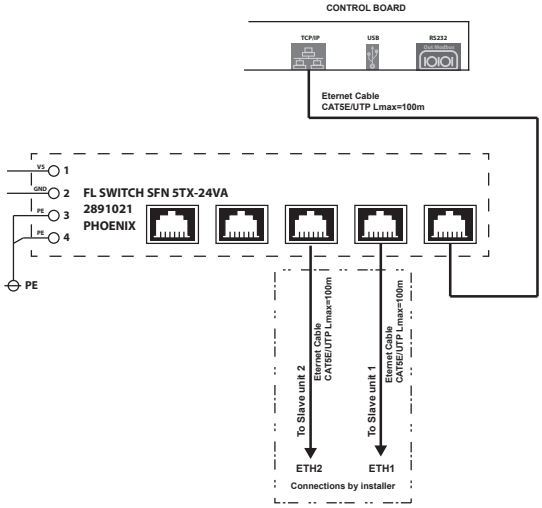


Fig. 59 Ethernet switch for Multilogic network in Master unit - example

6.4 Exclusions from Multilogic option supply

A list is provided below by way of exemplification, but not limited to it, of components/options that are excluded from the scope of our supply.

The supply of the Multilogic option does not include:

- electric cables;
- probe extensions;
- Ethernet cables;
- 2/3-way water on/off valves;
- non-return valves;
- expansion vessels;
- probe pockets and sleeves;
- centralized dry cooler management system (a request for the additional supply of this system may be filed at the negotiation stage);
- management system of centralized system pump;

any element connected to the implementation or installation of the hydraulic or electric system and whatever is not expressly included in the order acknowledgement.

7 SYSTEM COMMISSIONING

The following sections are intended to provide information on system installation and commissioning.

Operators gaining access to the system and to each individual unit must require the authorisations and qualifications set forth in the reference standards, based on the type of units installed, the type of refrigerant gas and the type of operations required, in addition to having proper knowledge to carry out any necessary operation throughout the technical life of the system/unit concerned.

7.1 Preliminary operations: commissioning of one single unit

Good practices before system commissioning require that each individual unit is started up one at a time. It is essential that the setup parameters of the units operating in standalone mode are consistent with the system requirements.

The checks that should be carried out before starting up the individual units include the following:

- make sure that all the manual shutter valves present on the installation are open, especially those on the pumps;
- if the pumps are controlled by an inverter not supplied with them, make sure they are connected and programmed correctly;
- make sure that the hydraulic system is fully vented, eliminating any traces of air, charging it gradually and opening the venting devices on the upper part;
- make sure that the pumps have been vented correctly;
- check that the installation technician has prepared an expansion tank capable of holding the volume of water contained by the installation;
- if there are any pressure sensors present, check that the point where they are installed has been vented;
- check that the system pressure corresponds to the design value.

All installation, safety and start-up instructions and precautions must be adhered to, as well as whatever is required by the guidelines provided in the User and Maintenance Manuals specific to each unit.

It is also important that the max. and min. water flow rate conditions are identified and the unit is tested in such conditions, as well as in nominal conditions. Normally, the water flow rate during operation must not be 1.5 times higher and 0.5 times lower than the nominal flow rate of the unit specified in the Technical Catalogue.

In any case, refer to the specific Technical Catalogue or in the specific technical selection for the allowed conditions for water flow in and out of the exchangers.

If external devices such as, but not limited to it, water valves, dedicated pumps piloted by the units individually, water flow switches, dry cooler systems, etc. are fitted in the unit, an electrical check must be made that the connections are correct and in good working order, followed by a mechanical and finally a functional test.

7.2 Inspection of system probes

After testing all the units individually and confirming correct operation in standalone mode, we recommend that a test be made of the readings of the system probes connected to the Master unit.

In particular:

- it is advisable to test the reading under both max. and min. water flow conditions, one probe at a time;
- the best procedure consists in checking that the probe is placed consistently with its function;
- change the temperature at the measurement point and check that the corresponding reading on the Master unit is consistent with the temperature change;
- check that the reading on the Master is correct and it matches the actual temperature. Our recommendation in this case is that a monitoring tool is used and its reading point placed as close as possible to the measurement point of the probe under testing;
- carry out another test before starting the circulation pumps, but without thermal load and without switching the compressors on. The two probes (delivery/return) are supposed to read the same value approximately (net of a tolerance of around +/- 0.5°C).

7.3 Changing the IP and the serial addresses

After testing the probe readings, we recommend that the IP address of each unit is changed/checked.

When required for installation needs, we recommend that, after changing the IP address, power is cut out and then restored in order to check that the IP address has been changed successfully (go to the built-in Web Server pages and check the readings). The check is made using a direct Ethernet connection with a PC having a correctly configured network interface controller.

The table below explain the addresses sequence

	Indirizzo IP costruttore	Indirizzo IP "custom"	SP12
Master	10.2.3.20	aaa.bbb.ccc.(xxx)	1
Salve 1	10.2.3.21	aaa.bbb.ccc.(xxx + 1)	2
Salve 2	10.2.3.22	aaa.bbb.ccc.(xxx + 2)	3
...	...	...	...
Salve "n"	10.2.3.(20+n)	aaa.bbb.ccc.(xxx + n)	n + 1

7.4 Unit connection and Multilogic/Multifree testing

Now, the units can be connected to the Ethernet switch featured in the Master unit and the "CF11" and "SP12" setpoints can be edited on each unit, as described in the sections above.

The number of Multilogic/Multifree units must be set into the Master as well, as described in the next section.

The installer is in charge of laying the communication cables and making the connection between the various units, following the instructions provided in the wiring diagrams of each unit.

Upon completion of the connections to the network switch, communication can be checked on all the units, using a PC having the same network structure as the units, from the pages of the built-in Web Server of each unit. As parameters "CF11" and "SP12" are already set up, the pages of the built-in Web Server of the Master unit give access to the Multilogic / Multifree section in which it is possible to view the system data, the Master data and the data of the connected Slave units, which is an additional communication test. Access to the Multilogic / Multifree section may also be gained from the pages of the Web Server of the Slave units where data pertaining to the Slave units are displayed.

After the parameter values have been edited and all the units connected:

- the readings of the probes in the various screens must be correct;
- no communication alarm must be present. If some units are offline, the need exists to identify them and to check again the setpoints and wirings, as described in the previous point.

On the unit's display, the text "ML" steady, indicates that all the units are online; "ML" is flashing at the Master's display if at least one Slave is offline and it is flashing at the offline Slave display too. If a unit is offline, the alarm AL16 appears.

NOTE Communication problems in some cases may be linked to a slowdown in the exchange of data among the units. This is especially true if units communicate through the client's network. Where this is the case, the communication alarm delays may require editing. We recommend that the manufacturer always be contacted in these cases.

The other connections, as remote digital ON/OFF free contacts, or the Summer/Winter remote free contacts, or the remote free contact to enable or disable the hot and cold side to a multi-purpose unit, and the digital alarm output, whether required, must be done to the Master only, and the Slaves must be properly configured.

Anyhow, the general alarm digital output can be connected to the Slaves as well, but the output give the alarm status of the only one Slave where the alarm it is connected.

7.5 Multilogic / Multifree parameter setup

The Multilogic / Multifree parameters should be set up on the Master unit first and then on the Slave units.

The parameters “CF11” and the respective IP and SP12 serial addresses are alredy modified as described into the above sections “7.3 Changing the IP and the serial address” and “7.4 Unit connection and Multilogic/ Multifree testing”.

The values indicated below are set by manufacturer if not differently agreed and indicated in the order. Anyhow, all the parameters involved in the Multilogic/Multifree operation are set in according with the installation needs.

The Multilogic/Multifree operates with a Neutral zone and PID control on the outlet water temperature plant probe, so is it advisable to check/set the same control type in stand alone too.

The activation and deactivation bands are pre-set from manufacturer in according with the number and the unit type inside the order confirmation with Multilogic: Anyhow the bands can be edited if the default settin does not mach the plant needs.

The table below summarize the parameters that can be edited and it can be used like a reminder.

Legend:

- the “**installation**” column can be used to indicate the setting of the plant in case of the default value modification. **If the value is already present**, it means the value is the **suggested** value for a good Multilogic/Multifree setting;
- the text **“n.a.”** means the parameter/function is not appliable the unit or the parameters must not set;
- the text **“Manufacturer”**, means the parameter is under manufacturer level ,so the Service cannot modify it.

	Edit on	Multilogic / Multifree Manufacturer setting	Multilogic for Multi-purpose units Manufacturer setting	Installation
Number of unit Master included	Master	MS2 = Quantity into the order	MS2 = Quantity into the order	-
		MS_FC5 = Quantity into the order	**“n.a.”**	-
Number of backup units	Master	MS69 = 0	MS69 = 0	-
		MS_FC4 = 0	**“n.a.”**	**0**
Booster	Master	MS70 = 0 – No	MS70 = 0 – No **“Manufacturer”**	-
		MS74 = 30,0 °C	MS74 = 25,0 °C **“n.a.”**	-
		MS75 = 5,0 °C	MS75 = 5,0 °C **“n.a.”**	-
		MS76 = 3 min.	MS76 = 15 min. **“n.a.”**	**3 min.**
		MS78 = 20,0 °C	MS79 = 25,0 °C **“n.a.”**	-
		MS79 = 5,0 °C	MS80 = 5,0 °C **“n.a.”**	-
Capacity distribution	Master	MS6 = 2- Optimized	MS7 = 2 – Optimized **“Manufacturer”**	-
		MS43 In according with the unit type	MS43 = 25 % **“Manufacturer”**	-
		MS44 In according with the unit type	MS44 = 50 % **“Manufacturer”**	-
		MS_FC3 = 1 - Saturation	**“n.a.”**	-

	Edit on	Multilogic / Multifree Manufacturer setting	Multilogic for Multi-purpose units Manufacturer setting	Installation
Priorities	Master	MS5 = 1 (master)	MS5 = 1 (master)	**1**
		MS11 = 1 (Slave 1)	MS11 = 1 (Slave 1) **"Manufacturer"**	**1**
		MS12 = 1 (Slave 2)	MS12 = 1 (Slave 2) **"Manufacturer"**	**1**
		MS13 = 1 (Slave 3)	MS13 = 1 (Slave 3) **"Manufacturer"**	**1**
		MS14 = 1 (Slave 4)	MS14 = 1 (Slave 4) **"Manufacturer"**	**1**
		MS15 = 1 (Slave 5)	MS15 = 1 (Slave 5) **"Manufacturer"**	**1**
		And so on until the last Salve	**"Manufacturer"**	-
Offline behavior	Master	MS4 = 1 – Stand-alone	MS4 = 1 – Stand-alone	**1**
		MS47 = 1 – Stand-alone	**"n.a."**	**1**
	Slave	MS47 = 1 – Stand-alone	MS4 = 1 – Stand-alone	**1**
Unit rotation	Master	**"n.a."**	MS6 = 1	**2**
		MS71 = 8 hours	MS71 = 24 hours	-
		MS31 = 00:10	**"n.a."**	-
		MS32 = 1 - Sunday	**"n.a."**	-
Setpoints and limits	Master and Slave	MS49 = ST1	MS49 = ST1	-
		MS50 = ST2	MS50 = ST2	-
		MS51 = ST3	MS51 = ST3	-
		MS52 = ST4	MS82 = STH4	-
		MS53 = ST5	MS83 = STH5	-
		MS54 = ST6	MS84 = STH6	-
Water pump management	Master	PA20 = 1	**"n.a."**	**1**
	Master and Slave	PA1 = 1 – Continuous operation	PA1 = 1 – Continuous operation	**2**
		PA24 = 1 - Continuous operation (only for Water/Water units)	PA24 = 1 - Continuous operation	**2**
Selection type Chiller / Heat Pumps	Master	SP9 = 1 – from digital input	**"n.a."**	**0 / 1**
	Slave	SP9 = 1 – from digital input	**"n.a."**	**0**

After system setting is completed, a test can be made that capacity distribution and unit activation occur according to the relevant setpoints by simulating the control probe reading. All the probe readings, the capacity values calculated by the system and capacity distribution to the various units concerned are checked by connecting to the Web pages of the Master unit, and a simulation can be made of a rotation event in cases when units are set up in backup mode.

NOTE All the steps illustrated above must be performed with all the units OFF. Preliminary operating tests of the Multilogic/Multifree system must be carried out with the cooling or heating devices disabled.
It is advisable to carry out an offline unit test to each units, to check the system behaves in according with the setting.

If the tests show that the system behaves consistently with the setpoints, a final test can be run with the cooling and heating devices enabled.

In presence of water flowing in one unit, the reading of the water inlet/outlet probes in the system must be consistent with the reading of the water inlet/outlet probes in the local units. Where discrepancies are experienced between these values, the position and accuracy of the probes as well as their correct connection to the corresponding analogue inputs must be checked.

Management of the secondary circuit in the system is not part of the area of competence/scope of the Multilogic/Multifree system.

7.6 Alarms and malfunctions

Where an alarm triggers or a malfunction is experienced, it is important to check whether:

- the alarms are communication alarms, in which case points “3” and “4” above must be repeated;
- the malfunctions are attributable to one single unit, in which case point “1” must be repeated;
- the malfunctions are system-related malfunctions, in which case it is necessary to repeat: point “1” if the experienced problems relate to the water flow rates; point “2” in the event of reading errors concerning the system probes; or point “4” and point “5” in the event of errors or malfunctions experienced by the Multilogic system.

Whether a unit is in alarm condition, the Multilogic reacts in different ways based on the alarm type itself:

- if the alarm conditions does not stop completely the unit, the Multilogic consider the unit as totally operating and does not modify the capacity distribution or the system on running status;
- if the alarm stops completely the unit and it is not more available (i.e a water flow alarm, for example), the Master replaces the not available unit with a backup unit if available; in any case the Master makes a new capacity calculation. it is advisable to test the system with a water flow alarm, to check the setting done.

7.7 Temporary stop

The stopping of the system for a few hours in the day “during non-working hours” or for a few days “over the weekend” is considered temporary.

The system must be stopped through the Master unit using the controller display, the external OK signal or serially, where applicable, by switching the Master unit to OFF.

All instructions and precautions concerning temporary system stopping provided in the User and Maintenance Manuals specific to each unit must be adhered to.

When the temporary stop is carried out in this way, all that needs to be done to restart the unit is to set the controller in the Master unit to “ON”.

7.8 Stop for long periods of time

If the unit is to be stopped for a season or for long periods of time, it is generally necessary to:

- switch off the Master unit, as a consequence of which all the Slave units in the system will be switched off;
- disconnect the power supply using the power switch of the units;
- drain the hydraulic system (unless it contains glycol water with the correct percentage of glycol). While draining the hydraulic system, pay attention and prevent the pumps from starting without water in antifreeze mode.

All instructions and precautions concerning system stopping for long periods of time provided in the User and Maintenance Manuals specific to each unit must be adhered to.

When the system is started up again, **which needs to be done by authorised staff**, the start-up procedure described in the sections above must be repeated, i.e. each individual unit must be started first, followed by the system, making sure that the Multilogic / Multifree parameter values match the system commissioning values.

7.9 Maintenance

With reference to routine maintenance of the units featured in the Multilogic/Multifree system, reference should be made to the maintenance sheets of the featured units which are provided in the User and Maintenance Manual of each unit.

As for components excluded from the scope of supply of the Multilogic/Multifree system, reference should be made to the specifications provided by the component manufacturer.

Moreover:

- it is appropriate to check the reading and the proper condition of the system probes, the tightening of the electric terminals and the electrical connections, including the those of the communication cables inside the electrical cabinet and the terminal boards, at **monthly** intervals;
- we recommend drafting a full sheet in which all the activities to be made on the single units and devices in the system are listed, including the time interval of the checks.

This planning refers to an average installation; there could be installations in which it may be necessary to increase the frequency of some checks.

Current legislation may require considerably longer intervals on periodic checks than the recommended ones, also in reference to the safety devices installed and to the refrigerant charge present, without causing the warranty on the unit to be voided.

All the existing regulations, the instructions and precautions concerning maintenance operations provided in the User and Maintenance Manuals specific to each unit must be adhered to.

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