

# MasterAria

electronic controller

# CAREL



## **(ENG)** User manual

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THESE INSTRUCTIONS**



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- do not use the product for applications other than those specified in the technical manual.

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The product is made from metal parts and plastic parts. In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
3. the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.



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## 1. INTRODUCTION

### Features of the MasterAria family:

- “Acqua” remote terminal with an elegant appearance, built-in room temperature sensor and diversified access to the various functions (values set using the front buttons, operating mode changed using the side buttons);
- Control board with high number of I/Os (5 digital inputs, 3 probes, 5 relay outputs and dipoles for simple configuration by the installer);
- Custom connection to supervisory systems with the numerous protocols supported (Modbus®, PlantVisor);
- Parameter programming key (accessory);
- Expansion board to control modulating 3-point or ON/OFF valves (accessories)

MasterAria is a product designed for small air heater and air handling unit (AHU) market, for both units with outside air only and with recirculation or heat recovery units. It is used to manage a hot/cold water coil with modulating valve and modulating outside air damper or alternatively two coils with modulating valve and ON/OFF outside damper. The compact electrical panel (IP54) contains the main control board, the expansion board with 2 modulating 0 to 10 Vdc outputs and 2 relay outputs, the circuit breaker and the fan protection and control contactor. Versions are available for the control of single-phase and three-phase fan motors, with the possibility to adjust the maximum cutoff current.

The product can also be supplied without the electrical panel, with the

main control board and expansion board selected with 2 modulating 0 to 10 Vdc outputs and 2 relay outputs, 4 triac outputs, 2 triac outputs and 2 relays, or 4 relay outputs and the “acqua” remote terminal.

The 3 outputs on the main board for controlling the fan can be used to manage single-phase 3-speed fans (the first output controls the contactor in the MasterAria electrical panel) and three-phase fans.

The system is simple to configure by setting the dipoles on the main control board and the parameters on the “acqua” remote terminal; this can in fact be used to display the alarms, set the parameters and the on/off time bands.

The possibility of configure the outputs and the availability of various expansion boards means various types of loads can be controlled, such as hot/cold water coil valves, heaters, hot and cold water signals to the chiller/heat pump and boiler, outside damper, recirculation damper and heat recovery unit damper.

The RS485 serial board (accessory) can be used to create custom (PlantVisor) or open (Modbus®) supervisory systems.

Finally, the pCOWeb board (accessory) can be used to connect MasterAria to a computer on an intranet, or alternatively to save the variables and graphs to a file that can be sent using Internet Explorer™.

## 2. USER

The user interface is the “acqua” remote terminal, featuring a user-friendly liquid crystal display.

### 2.1 “Acqua” remote terminal

**i** In summary:

- built-in NTC sensor to control the room temperature;
- LCD with intuitive symbols;
- selection of the value displayed (temperature, set point, offset from common set point);
- selective keypad lock (limited functions for offices, hotels);
- manual or automatic operation;
- ON/OFF timer functions;
- sleep function.

Below is a description of the terminal and the symbols shown on the liquid crystal display:

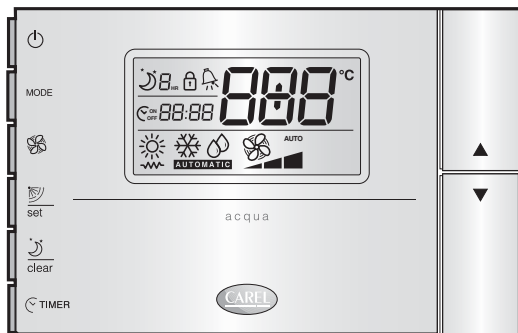


Fig. 2.a

butt.	meaning
	Air handling unit (AHU) ON/OFF. If the remote ON/OFF digital input is available, the function of the button can be disabled.
MODE	Used to select the desired operating mode: cooling (snowflake), heating (sun), dehumidification, ventilation, AUTOMATIC. If the remote cooling/heating digital input is available, this button can be disabled.
	Pressing repeatedly sets the fan speed (min, med, max, automatic=AUTO).
set	Confirms to the changes made to the parameters.
clear	Pressing once activates the sleep function, pressing again selects the duration of the sleep function in hours (if more than three seconds elapse from when the button was previously pressed, the function is deactivated). After pressing 9 consecutive times, the function is deactivated.
TIMER	Holding the button sets the current time. Pressing once selects the MasterAria ON time (changed using UP & DOWN), pressing again selects the OFF time, and pressing a third time exits the timer programming procedure.
	Increase value (UP)
	Decrease value (DOWN)

Tab. 2.a

**!** **Important:** The fan speed can only be selected using the fan button if parameter 118 = 0.

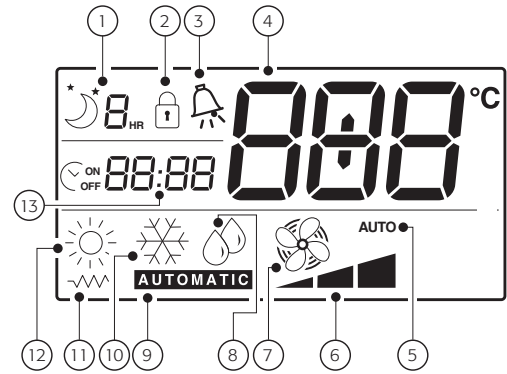


Fig. 2.b

Key:

1. sleep function
2. limited keypad function
3. active alarm
4. display value
5. fan speed in automatic mode
6. fan speed setting indicator (min/med/max)
7. fan
8. dehumidification
9. automatic operation
10. cooling
11. heating with heater
12. heating
13. current time

Below is a description of all the operating modes available on MasterAria. The device can in any case be reconfigured by the manufacturer of the cooling/heating system or the installer (based on the features of the system), and therefore some functions may be not available.

### 2.2 Operating modes

#### Cooling

Once having switched the device on, by pressing the ON/OFF button:

- Repeatedly press the MODE button until the cooling symbol (snowflake) comes on.
- Set the set point (desired temperature) using the UP & DOWN buttons.
- Repeatedly press the fan button to select the desired fan speed; if AUTO mode is selected, the speed is decided by the electronic controller based on the deviation from the set point (the greater the deviation, the higher the speed).

If the COOL ENABLE function is active, the fan is started only if the coil temperature is low enough, to avoid undesired flows of hot air. If this condition is not satisfied, the cooling symbol (snowflake) flashes.



Fig. 2.c

### Heating

Once having switched the device on, by pressing the ON/OFF button:

- Repeatedly press the MODE button until the heating symbol only (sun) or the heating symbol with heater, if installed (\*), comes on. In the latter case, the electric heater is also used as a source of heat;
- Set the set point (desired temperature) using the UP & DOWN buttons;
- Repeatedly press the fan button to select the desired fan speed; if AUTO mode is selected, the speed is decided by the electronic controller based on the deviation from the set point (the greater the deviation, the higher the speed).

If the HEAT ENABLE function is active, the fan is started only if the coil temperature is high enough, to avoid undesired flows of cold air. If this condition is not satisfied the heating symbol (sun) flashes.

If the electric heater is installed (signalled by the corresponding symbol on the display), the fan continues operating for 20 seconds after it has been deactivated. This time is also maintained when switching off the device using the ON/OFF button.



Fig. 2.g

### AUTOMATIC

Once having switched the device on, by pressing the ON/OFF button:

- Repeatedly press the MODE button until the AUTOMATIC symbol comes on;
- Set the set point (desired temperature) using the UP & DOWN buttons;
- Repeatedly press the fan button to select the desired fan speed; if AUTO mode is selected, the speed is decided by the electronic controller based on the deviation from the set point (the greater the deviation, the higher the speed).

The operating mode (heating or cooling) is decided by the electronic controller based on the deviation from the set point: if the room temperature is higher than the set point, the controller activates cooling mode, while if it is lower heating mode is activated.

The fan is started only if the coil temperature is suitable for the heating or cooling functions.

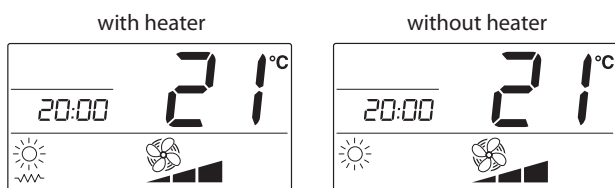


Fig. 2.d

Fig. 2.e

(\*): For the installation of the electric heater, see the paragraph on "Configuration".

### Dehumidification

Once having switched the device on, by pressing the ON/OFF button:

- Repeatedly press the MODE button until the dehumidification symbol (droplets) comes on;
- Set the set point (desired temperature) using the UP & DOWN buttons;
- Repeatedly press the fan button to select the desired fan speed; if AUTO mode is selected, the fan works at minimum speed.

The fan is started only if the coil temperature is low enough, so as to avoid undesired flow of hot and humid air. If this condition is not satisfied, the dehumidification symbol flashes. MasterAria starts in cooling mode so as to bring the room temperature closer to the set point (set point +3 °C) using the selected speed, and then runs fan on/off cycles at minimum speed to decrease the humidity.



Fig. 2.f

### Ventilation

This operating mode can be disabled by setting parameter 38=8. The mode may be useful for circulating the air in the room. In this case, also set the minimum opening of the outside damper (parameter 119> 0%).

Once having switched the device on, by pressing the ON/OFF button:

- Repeatedly press the MODE button so that only the fan symbol is on (at the bottom of the display) together with the corresponding speed bar.
- Repeatedly press the fan button to select the desired fan speed; if AUTO mode is selected, the speed is set to medium.

The fan is started only if the room temperature is within the range of temperatures from 15 to 35 °C, to avoid undesired flows of hot or cold air.

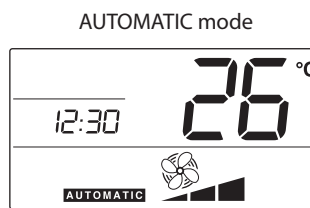


Fig. 2.h

### Comfort

In some systems, the set point is decided by the manager of the installation; in these cases, the user may increase or decrease the set point by up to 3 °C to compensate for different perception of the room temperature. The value is changed by pressing the UP and DOWN buttons and is displayed for 5 seconds, after which the previous display resumes.

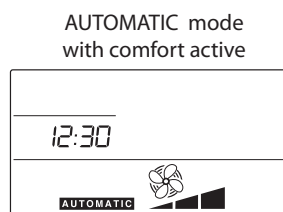


Fig. 2.i

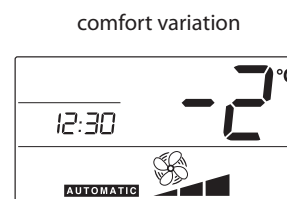


Fig. 2.j

**Sleep**

The sleep function is especially useful at night, when the decrease in body temperature (due to sleep) changes the perception of the room temperature.

In cooling mode the set point is increased by the value of the parameter 18 for the number of hours specified on the display, after which MasterAria returns to the previous situation (the sleep function is cancelled).

In heating mode the set point is decreased by the value of parameter 19.

To set the sleep function:

- Switch the device on using the ON/OFF button and select the operating mode;
- Press the clear button repeatedly until setting the required number of hours for the function.

To cancel this function, press the clear button again, after having waited 3 seconds from when the button was last pressed, or pressing the button more than once until exceeding the maximum number of hours, that is, 9.

Sleep operation can be activated by a digital input that has been configured accordingly. In this case, the function is called "economy" (see the paragraph on "Digital inputs").

**Remote off**

Activated when dipswitch 3 = ON

When the remote off symbol (lock) is shown the operating mode is set to AUTOMATIC (with heater, if installed) and the user can: switch the unit on/off, modify the set point and set the fan speed; the other functions are not available.

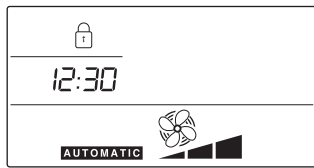


Fig. 2.k

**Disabling the operating modes**

Parameter 38 is used to reduce the number of operating modes available on the "acqua" terminal. The setting is achieved by adding the values shown below, each of which corresponds to disabling the corresponding mode.

1	AUTOMATIC
2	cooling
4	dehumidification
8	ventilation
16	heating
32	autofan (see corresponding paragraph)
64	sleep
128	ON/OFF timer & time display

**2.3 Setting the clock and On/Off times (timer)**

**Setting the time**

MasterAria offers the possibility to perform programmed starts and stops if the room only needs to be air-conditioned at certain times of the day. To be able to use these functions, the internal clock needs to be set with the correct time, as shown below:

1. Hold the timer button for 5 seconds (the clock icon appears);
2. Set the time using the UP and DOWN buttons (the time flashes);
3. Confirm by pressing the SET button (the time is displayed steady).

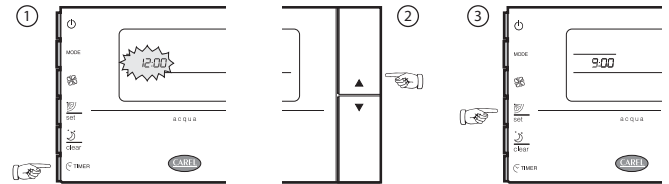


Fig. 2.l

**Important:** In the event of power failures, the time returns to 12:00 and must be set again. The time display can be disabled by setting parameter 38=128.

**Setting the on and off times**

- Press the TIMER button once;
- Set the required ON time with the UP and DOWN buttons (the time flashes);
- Confirm the time with the "set" button (the symbol is on steady and the current time is displayed): the clock icon is shown with the text ON.

The OFF timer is set in the same way as the ON timer, with the difference that the TIMER button must be pressed twice.

**Important:** In the event of power failures, the timer values are lost and must be reset.

The ON/OFF timer functions remain active even after the corresponding On/Off event has occurred; to disable these functions proceed as follows:

- Press the timer button: once to disable the timer ON or twice to disable the timer OFF (the time flashes);
- Press the "clear" button (the related symbol disappears).

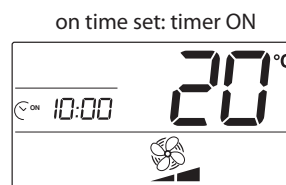


Fig. 2.m



Fig. 2.n

**Notes:** the On/Off times can be set independently.

### 3. INSTALLATION

**i** In summary:

- easy configuration by dipswitches;
- possibility of control with intake/return probe or probe on the "acqua" terminal;
- possibility to create supervisor networks using the RS485 serial board (accessory).

#### 3.1 MasterAria and accessories

Below is a description of the family of devices made up of MasterAria and its accessories:

##### Electrical panel

- **CTEM7\*: Single-phase version**
- **CTEDB\*: Three-phase version**

The electrical panel contains the main control board plus the expansion board with 2 x 0 to 10Vdc outputs and 2 relay outputs. It is also fitted with a disconnect switch, a power contactor for the fan and a circuit breaker



Fig. 3.a

##### MasterAria main control board (code HYCT000000)

Manages the fan and controls the temperature. Allows the connection of digital inputs for the remote control of functions such as ON/OFF, cooling/heating, economy (see sleep function) etc. Fitted, using the special accessory, with a serial port for the network connection of a series of units (supervisory system).

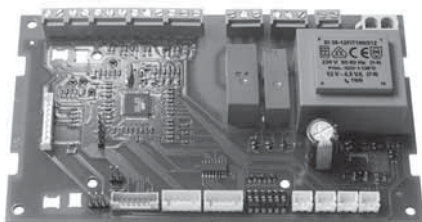


Fig. 3.b

##### Expansion board with analogue/relay outputs (code HYVC000V00)

Allows MasterAria to control two actuators with 0 to 10 Vdc inputs (e.g.: modulating valves, etc.) and control any additional loads using to the two multifunction relays.



Fig. 3.c

##### Expansion board with 4 relays (code HYVC000R00)

Allows MasterAria to manage ON/OFF actuators (valves, heaters, dampers) and the hot and cold water signals to the chiller and heat pump/boiler).



Fig. 3.d

##### Expansion board with 2 triac/relay outputs (code HYVC000M00)

Allows MasterAria to control loads with a high number of operations (e.g.: modulating 3 point valves, etc.) using the 2 triac outputs with voltage signal (230 Vac) and directly control a 2 kW heater. A second multifunction relay is available for any additional loads.



Fig. 3.e

##### Expansion board with 4 triacs (code HYVC000T00)

Allows MasterAria to control loads with a high number of operations (e.g.: modulating 3 point valves, etc.) using the 4 triac outputs with voltage signal (230 Vac).

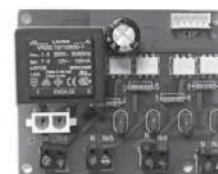


Fig. 3.f

**RS485 serial board (code HYSC00F0P0, accessory)**

Used to create custom (PlantVisor) or open (Modbus®) supervisory systems.

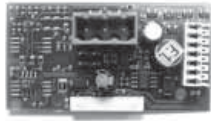


Fig. 3.g

**Programming key (code PSOPZKEY00, accessory)**

Used to simply export the configuration of the parameters from one MasterAria to another. PSOPZKEYA0 is the version with power supply.



Fig. 3.h

**Adapter for MasterAria programming key (code HYKA000000, accessory)**

To be used together with the programming key PSOPZKEY00.



Fig. 3.i

**“Acqua” LCD terminal for MasterAria (code HYPA001000, accessory)**

Allows the user to set the operation of MasterAria and display the alarms. The LCD ensures straightforward and user-friendly operation. In addition, it is fitted with an NTC sensor that can be used for room temperature control.



Fig. 3.j

**3.2 Installation**

The electrical panel can be wall-mounted or installed in the air handling unit.

**Wall-mounting and dimensions:**

Identify the correct position on the wall, drill 4 holes, according to the drawing, and insert the plugs.

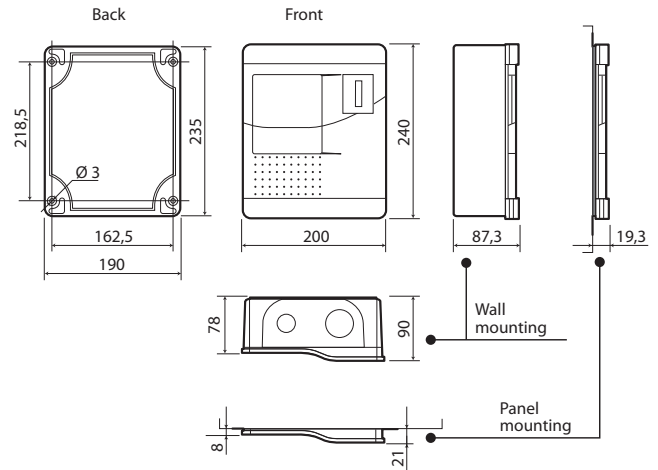


Fig. 3.k

Move the main switch on the panel to the OFF position and:

1. remove the top and bottom covers, and, without removing the front cover, insert the screws and fasten the panel to the wall;
2. now unscrew the 4 inside screws and remove the front cover to access to the electrical connections.

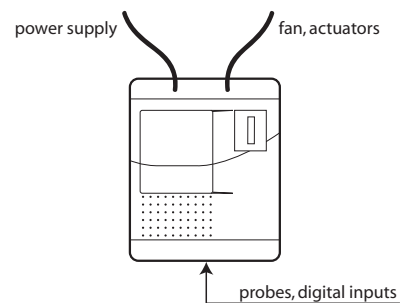
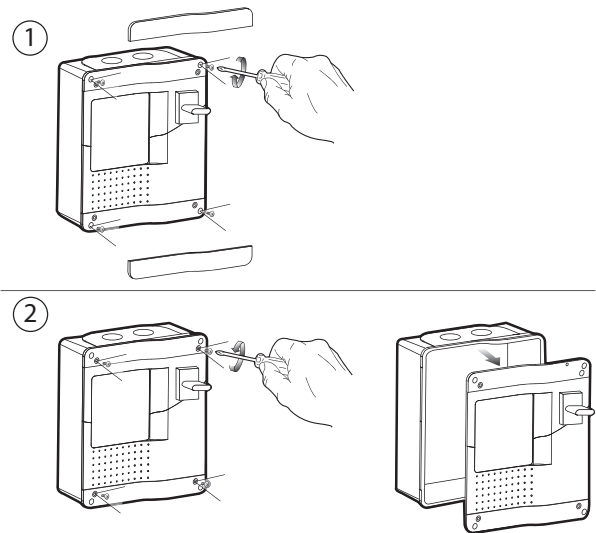


Fig. 3.l

**Note:** separate the power supply connections and the load cables from the probe and digital input cables.

Structure

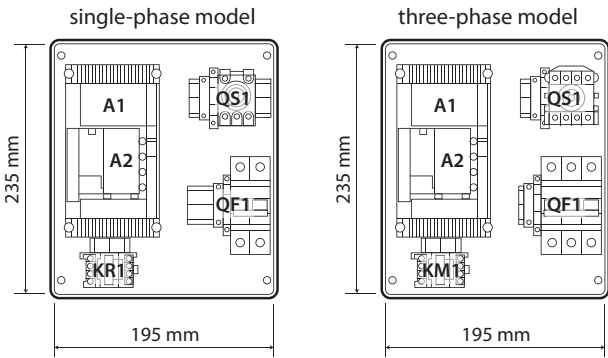


Fig. 3.m.a

Fig. 3.m.b

- Key:
- A1 Main control board
  - A2 Expansion board
  - KR1-KM1 Contactor
  - QS1 Main switch
  - QF1 Circuit breaker

Installing the boards and dimensions

The control kit consists of the main control board, an expansion board and the "acqua" terminal.

This is fastened to the electrical panel that controls the AHU using 4 plastic spacers (manufacturer RICHCO, code LCBS-8-01) inserted in the holes on the four corners of the main control board.

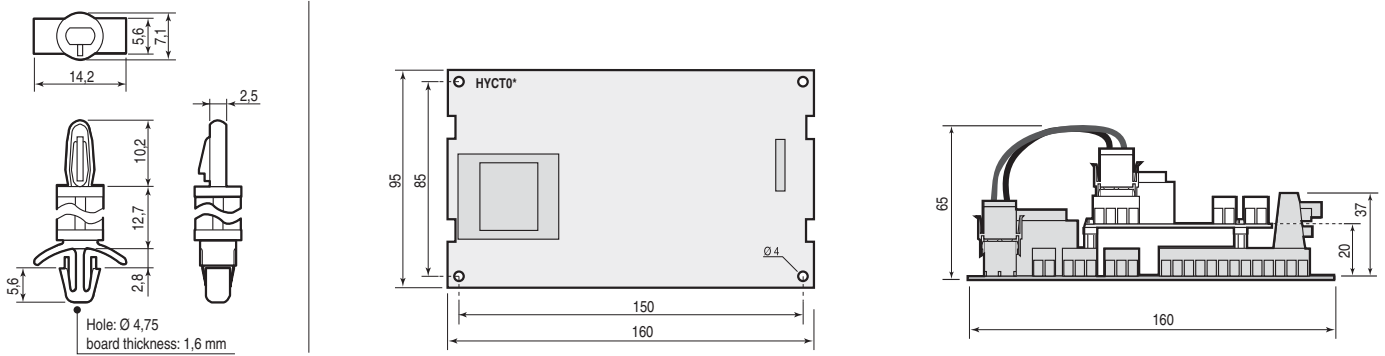


Fig. 3.n

3.4 MasterAria panel wiring diagram

MasterAria single phase

POWER SUPPLY 1P+N+T 230V ~ 50 Hz

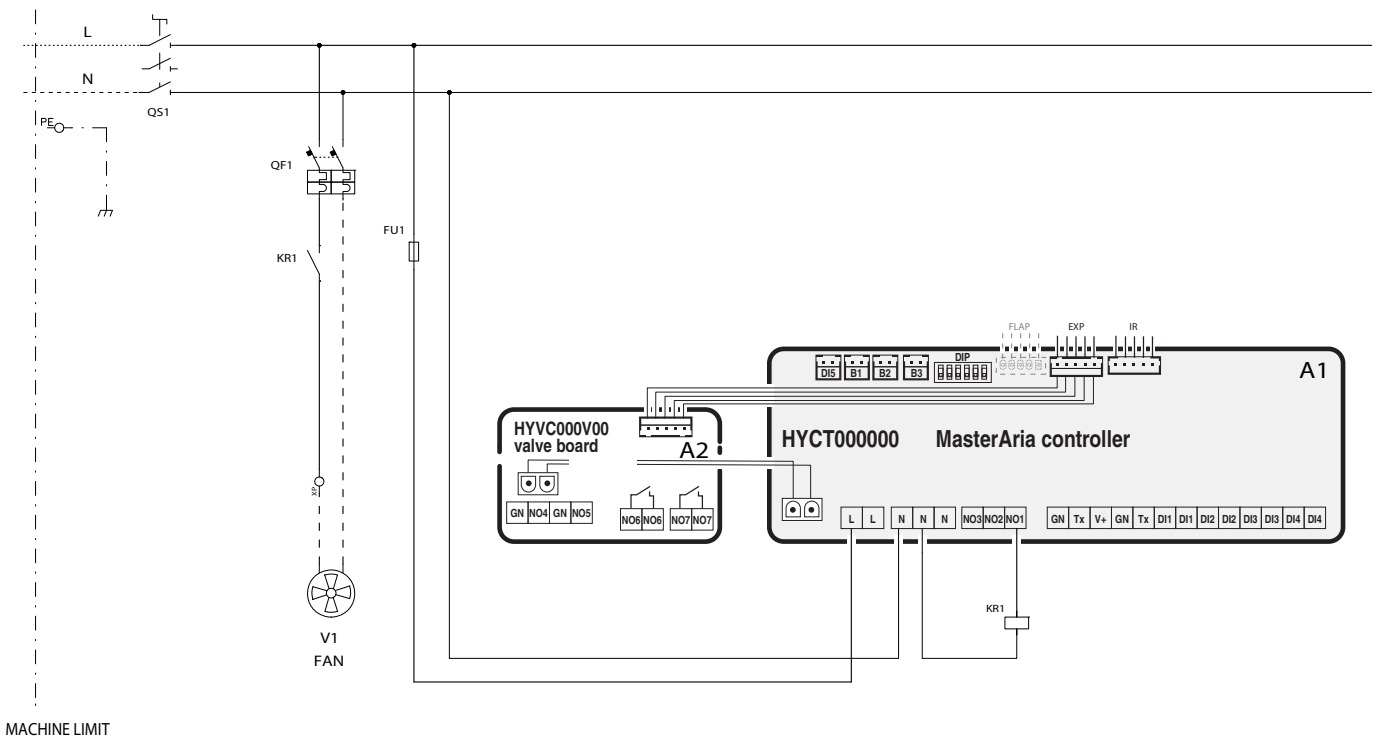


Fig. 3.o

MasterAria three phase

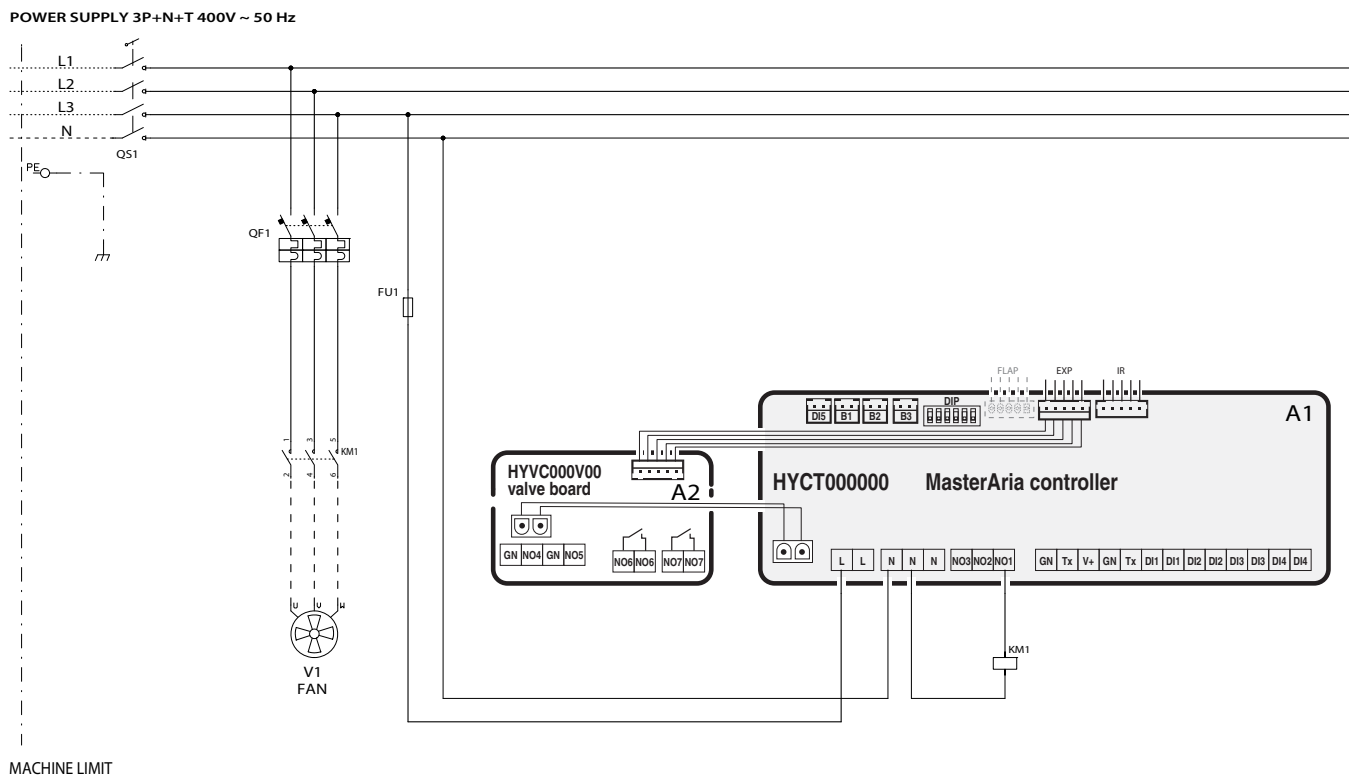


Fig. 3.p

- Key:
- A1 Main control board
  - A2 Expansion board
  - KR1-KM1 Contactor
  - QS1 Main switch
  - QF1 Circuit breaker
  - V1 Fan
  - FU1 Fuse

### 3.5 Connection diagrams

#### MasterAria connection diagram

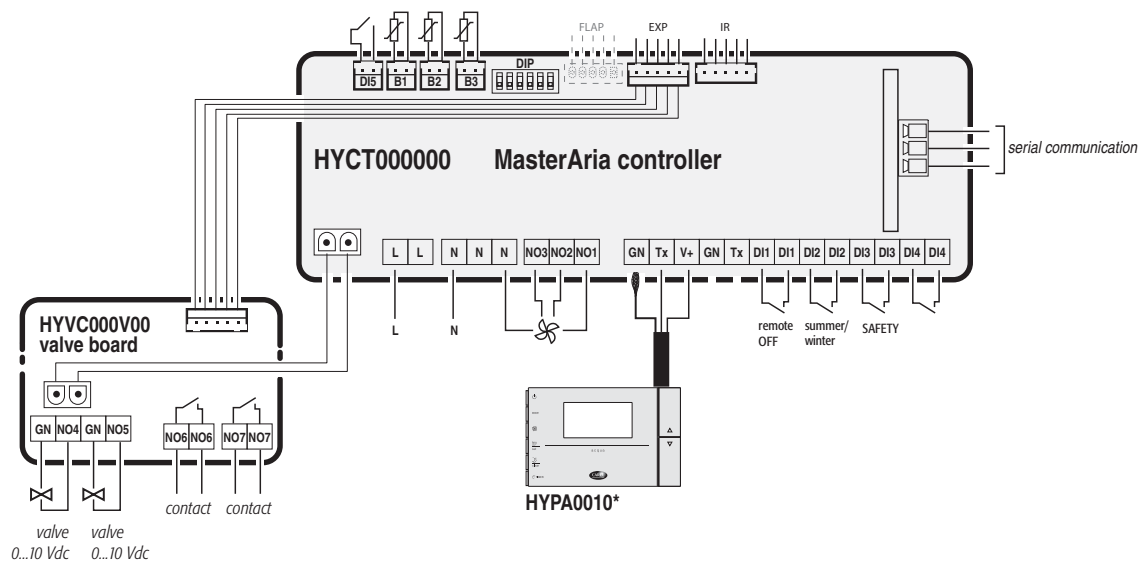


Fig. 3.q

**Important:** Digital inputs 1 and 2 have a fixed configuration. Digital inputs 3, 4, 5 can be configured.

Expansion board (accessories)

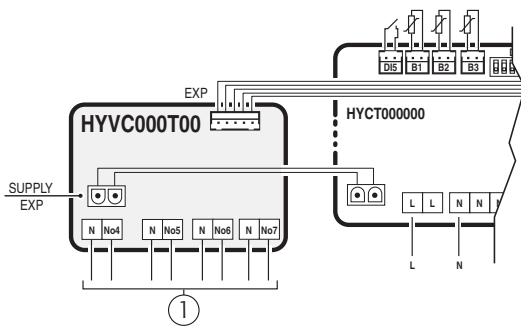


Fig. 3.r.a

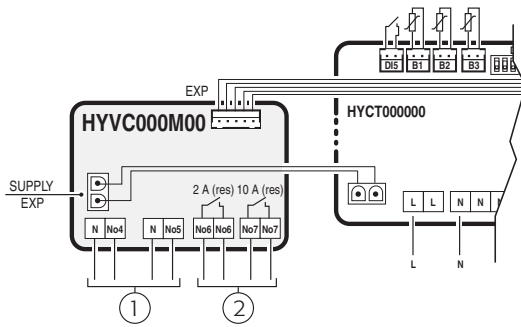


Fig. 3.r.b

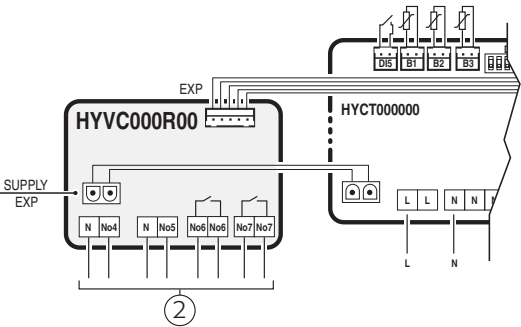


Fig. 3.r.c

- Key:
- 1. multifunction voltage output (triac)
  - 2. multifunction relay output

For the configuration of the inputs and outputs, see the paragraph on "Configuration".

For the technical specifications of the components, see the chapter: "Technical specifications and purchase codes".

3.6 "Acqua" remote terminal

Avoid installing the terminal in places where the room temperature measurement may be altered: outside walls, near doors leading to the outside, exposed to the sun, etc. (the terminal should be fastened to the wall in a horizontal position so as to allow the recirculation of air through the slits on the rear cover fastened to the wall). The terminal is fitted inside the plastic case and is only accessible by removing the rear shell (see the following figure).

Terminal assembly and dimensions

1. bottom view: opening tab;
2. fastening holes.

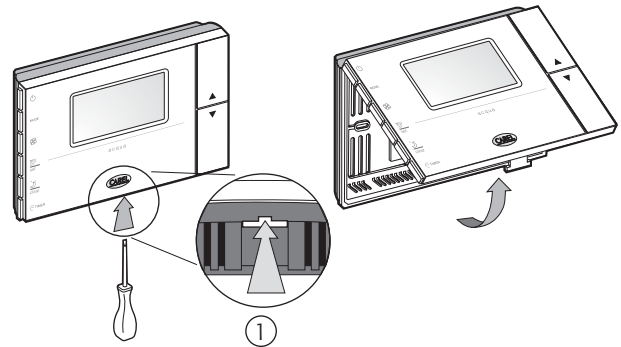


Fig. 3.s.a

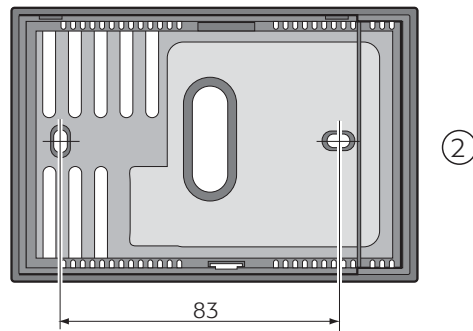


Fig. 3.s.b

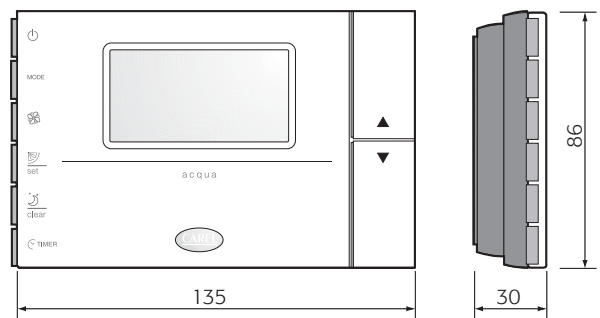


Fig. 3.s.c

For the connection see the connection diagram. If the temperature measured by the built-in sensor needs to be corrected (due to installation in a position that is not ideal) a fixed value in degrees centigrade can be added or subtracted (see parameter 61 in the table of parameters).

### 3.7 Programming key (copy the configuration)

Once having set the parameters (see the paragraph on “Configuration”), the configuration can be quickly copied to other MasterAria controllers using the programming key.

Proceed as follows:

1. switch off the previously programmed MasterAria (source);
2. set the dipswitches inside the programming key (underneath the battery cover) to reading mode (dip 1= OFF, dip2= OFF );
3. insert the key in the 4-pin connector on the adapter, and connect the 8-wire cable supplied (see Fig. 3.t);
4. insert the 8-wire cable from the programming key adapter to the IR connector on the board;
5. press the button. The red LED and then the green LED come on in succession, if the operation has been completed successfully. Other signals indicate problems (see the corresponding instruction sheet);
6. remove the key and the adapter; set the dipswitch to write mode (dip 1= OFF, dip2= ON ) and repeat steps 3, 4, 5, 6 to write the data to the target MasterAria;

**! Important:** to avoid excessively discharging the batteries in the programming key, disconnect the normally closed digital inputs on MasterAria. If this is not possible, use the key with the power supply. The MasterAria parameters (source) can be copied to target devices with the same or later software version.

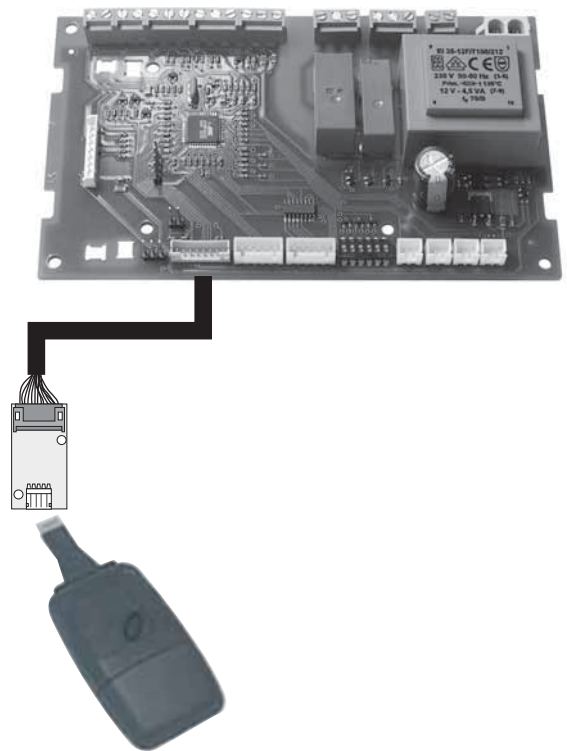


Fig. 3.t

### 3.8 Network connection

A series of MasterAria devices can be connected via network to a supervisor computer. In this case, a different address needs to be set for each device (parameter 69= Supervisory network address).

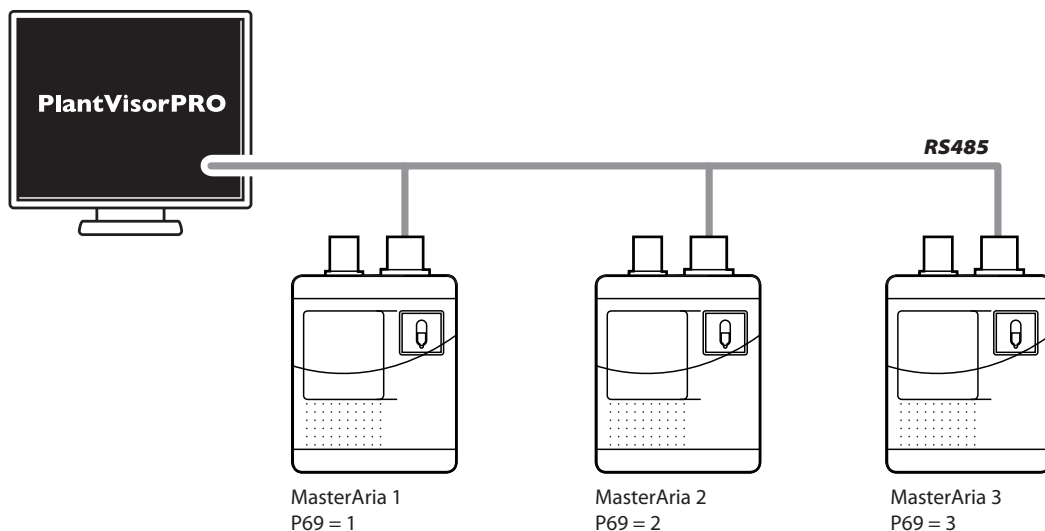


Fig. 3.u

## 4. ADVANCED SETTINGS

 In summary:

- fan speed control;
- algorithm to overcome the phenomenon of air stratification;
- antifreeze alarm management differentiated according to the type of unit;
- manual operation: cooling, heating (optional heater management), dehumidification, ventilation;
- automatic operation (optional heater management);
- room set point compensation with outside temperature reading;
- economy function: possibility to use a second set point if the environment is not occupied (energy saving); the Economy function is the same as sleep, with the difference that it is activated/deactivated by digital input;
- control of ON/OFF or modulating valves and dampers: three-point or with 0 to 10 Vdc input.

MasterAria provides a number of additional functions compared to traditional controllers: 2 digital inputs for remote ON/OFF and cooling/heating management, 3 configurable digital inputs, 3 probes, 4 configurable outputs, 6 dipswitches for rapid customisation on site, possibility of network connection for supervision.


MasterAria comes with a family of accessories (see the table of codes) including: the "acqua" terminal (with built-in NTC sensor), the expansion boards with 4 relay outputs, 4 triac outputs, 2 triac outputs and 2 relay outputs, the RS485 serial board.

The following section shows, in sequence, the description of the parameters, from the configuration of the I/O to the setting of the control algorithms. The list of parameters is shown at the end of the section.

### 4.1 Configuration


To select the type of air handling unit (AHU)/air heater unit, proceed as follows:

- connect the appropriate expansion board, if the board supplied is not suitable for the actuators used (the board supplied with the MasterAria electrical panel has two 0 to 10 Vdc outputs and two relay outputs, see the wiring diagram);
- set the dipswitches on the main control board;
- select the type of predefined unit (parameter P91) that best suits the application;
- on the "acqua" terminal, set the parameters for the inputs/outputs that differ from the chosen configuration.

 **Important:** if the AHU is OFF from digital input, the device cannot be configured on the acqua terminal.

### Outputs

The triac output should be preferred over the relay output when the actuator requires continuous switching (open/closed), as is the case with modulating 3-point valves.

 **Important:** Do not set outputs with option  $\leq 6$  and  $>6$  at the same time. This is because outputs with option  $> 6$  automatically imply the activation of the P+I algorithm, which is not suitable for the on/off outputs: options 1,2,5,6.

In any case, the following outputs can be used: chiller activation signal, boiler-heat pump activation signal and alarm. Only one output can be set as a heater.

#### Example:

MasterAria with board with two 0 to 10 Vdc outputs and 2 relay outputs:

incorrect	correct
P39 =13	P39 =13
P40 =21	P40 =21
P41 =6	P41 =18
P42 =24	P42 =24

Tab. 4.a.a

 **Important:** The outputs that are not used must be deactivated (option 0).

#### Table of outputs

	Output	Description	Assoc. pars.
Control board	NO1	Voltage output (L) for minimum fan speed	-
	NO2	Voltage output (L) for medium fan speed	-
	NO3	Voltage output (L) for maximum fan speed	-
Expansion board	NO4	Multifunction output (see DIP4)	P39
	NO5	Multifunction output (see DIP4 & DIP5)	P40
	NO6	Multifunction output	P41
	NO7	Multifunction output	P42

Tab. 4.a.b

The following summary table defines the type of output for each type of expansion board available.

Summary table of MasterAria options

Setting P39, P40, P41, P42	Accessory				Accessory				Supplied with MasterAria electrical panel				Accessory			
	Expansion board w/ 4 relays HYVC000R00				Expansion board w/ 4 triacs HYVC000T00				Expansion board w/ 0 to 10 Vdc + relays HYVC000V00				Expansion board w/ 2 triacs + 2 relays HYVC000M00			
	NO4 (volt. relay)	NO5 (volt. relay)	NO6 (relay)	NO7 (relay)	NO4 (volt. triac)	NO5 (volt. triac)	NO6 (volt. triac)	NO7 (volt. triac)	NO4 (0-10 Vdc)	NO5 (0-10 Vdc)	NO6 (relay)	NO7 (relay)	NO4 (volt. triac)	NO5 (volt. triac)	NO6 (relay 2 A)	NO7 (relay 10 A)
0	Output disabled															
1	ON/OFF cold water valve (norm. open)	√	√	√	√	√	√	√	√			√	√	√	√	√
2	ON/OFF hot water valve (norm. open)	√	√	√	√	√	√	√	√			√	√	√	√	√
3	Chiller activation signal, cold water request (norm. open). Contact closed with cold/hot water valve or cold water valve only active (open with valve deactivated)	√	√	√	√	√	√	√	√			√	√	√	√	√
4	Boiler, heat pump activation signal, hot water request (normally open). Contact closed with cold/hot water valve or hot water valve only active (open with valve deactivated)	√	√	√	√	√	√	√	√			√	√	√	√	√
5	ON/OFF hot/cold water valve (normally open). Activated with cooling/ heating request from controller. Off when are both deactivated	√	√	√	√	√	√	√	√			√	√	√	√	√
6	ON/OFF heater(normally open) (set parameters P46 & P13)	√	√	√	√	√	√	√	√			√	√	√	√	√
7	Alarm (normally open)	√	√	√	√	√	√	√	√			√	√	√	√	√
8	DO NOT SELECT															
9	3-point valve + (clockwise) for cold water (hot/cold water if dip4=OFF)*					√	√	√	√				√	√		
10	3-point valve - (anticlockwise) for cold water (hot/cold water if dip4=OFF)*					√	√	√	√				√	√		
11	3-point valve + (clockwise) for hot water (deactivated if dip4=OFF) *					√	√	√	√				√	√		
12	3-point valve - (anticlockwise) for hot water (deactivated if dip4=OFF) *					√	√	√	√				√	√		
13	Valve with 0 to 10 Vdc input for cold water (hot/ cold water if dip4=OFF) *									√	√					
14	Valve with 0 to 10 Vdc input for hot water (deactivated if dip4 =OFF) *									√	√					
15	DO NOT SELECT															
16	DO NOT SELECT															
17	0 to 10 Vdc output for modulating heater control (from external module). Set parameters P111, P117.*									√	√					
18	Output (triac or relay) for man. of ON/OFF heaters (with hysteresis) on P+I. Set parameters P111, P112.*	√	√	√	√	√	√	√	√			√	√	√	√	√
19	Open 3-point outside damper*					√	√	√	√							

Setting P39, P40, P41, P42	Accessory Expansion board w/ 4 relays HYVC000R00				Accessory Expansion board w/ 4 triacs HYVC000T00				Supplied with MasterAria electrical panel Expansion board w/ 0 to 10 Vdc + relays HYVC000V00				Accessory Expansion board w/ 2 triacs + 2 relays HYVC000M00			
	NO4 (volt. relay)	NO5 (volt. relay)	NO6 (relay)	NO7 (relay)	NO4 (volt. triac)	NO5 (volt. triac)	NO6 (volt. triac)	NO7 (volt. triac)	NO4 (0-10 Vdc)	NO5 (0-10 Vdc)	NO6 (relay)	NO7 (relay)	NO4 (volt. triac)	NO5 (volt. triac)	NO6 (relay 2 A)	NO7 (relay 10 A)
20					√	√	√	√								
21									√	√						
22																
23	√	√	√	√	√	√	√	√			√	√	√	√	√	√
24	√	√	√	√	√	√	√	√			√	√	√	√	√	√

(\*) The P-I parameters need to be set

Tab. 4.a.c

### Setting the dipswitches

The default setting of all the dipswitches on the main control board is off. Set the dipswitches based on the application.

Dipswitch	Setting	Notes
1	ON = enable heat/cool enable functions (probe B2 on coil). Probe B3 enabled only when DIP1=ON e DIP4= ON; OFF = heat/cool enable function disabled	
2	ON = enable digital input 2 for cooling/heating changeover OFF = disable digital input 2 for cooling/heating changeover	for operation of the function see par. P56: 0 N.C.=Heating, N.O.=Cooling 1 N.C.=Cooling, N.O.=Heating
3	ON = remote lock active OFF = remote lock not active	functions disabled: ON/OFF timer, Sleep, AUTOMATIC operation override
4	ON = AHU with 2 water coils OFF = AHU with 1 water coil	
5	ON = electric heater fitted OFF = electric heater not fitted	
6	ON = control probe is probe on "acqua" terminal (BT) OFF = control probe chosen from B1, B2 or B3 (must also correspond to P15, P16 or P17=5)	

Tab. 4.b

### Setting the parameters

To display and set the parameters, with device OFF, press the "MODE" and "clear" buttons for 5 seconds and enter the password 22 using the "UP" and "DOWN" buttons. Confirm by pressing "set". This accesses the user parameters only (U in the table of parameters).

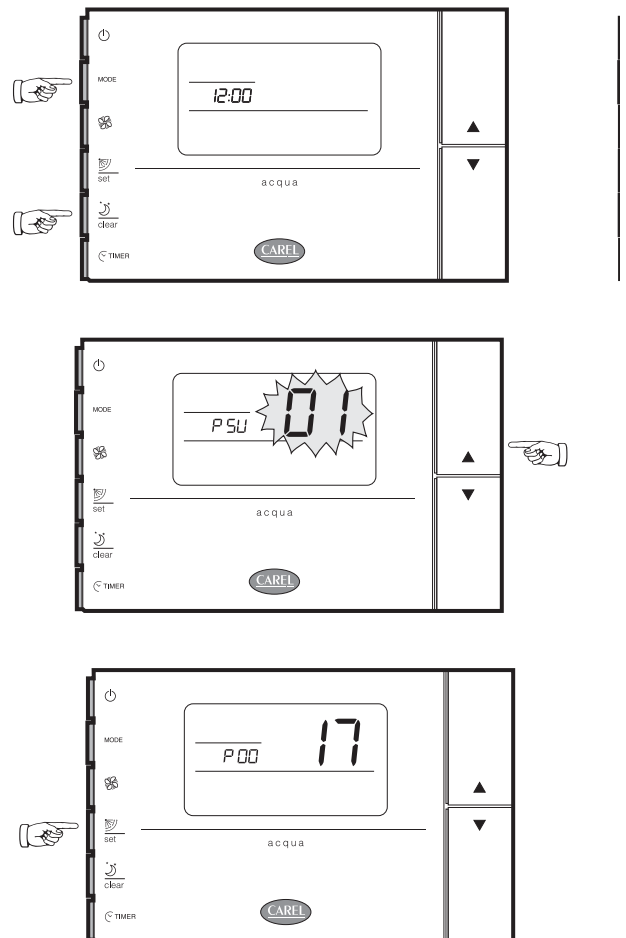


Fig. 4.a

To display and set the manufacturer parameters (F in the table of parameters), access the programming menu as described above, and enter the second password (PASSWORD = 66) for parameter P92.

### Automatic configuration of the inputs/outputs and type of unit (parameter 91)

To simplify configuration, one of the three automatic configurations can be used (columns "Def1, 2, 3" in the table of parameters):

- Switch the device off by pressing the ON/OFF button;
- Set parameter 91 according to the values shown in the table below.

	Inputs & Outputs	P91=44 AHU 100% outside air 0-10 V valves	P91=45 AHU with recirculation 0-10 V valves	P91=46 AHU with recirculation 3-point valves
Main board	ID1	ON/OFF	ON/OFF	ON/OFF
	ID2	Cooling/Heating	Cooling/Heating	Cooling/Heating
	ID3	Serious alarm	Serious alarm	Serious alarm
	ID4	Antifreeze alarm	Antifreeze alarm	Antifreeze alarm
	ID5	Filter alarm	Filter alarm	Filter alarm
	B1	Outlet temperature	Outlet temperature	Outlet temperature
	B2	Heating coil temperature	Heating/cooling coil temperature	Heating coil temperature
	B3	Outside temperature	Outside temperature	Outside temperature
	NO1	Single-speed outlet fan	Single-speed outlet fan	Single-speed outlet fan
	NO2	Disabled	Disabled	Disabled
Expansion board	NO3	Disabled	Disabled	Disabled
	NO4	Cool valve	Heating / cooling valve	Open heating / cooling valve
	NO5	Heat valve	Outside air damper	Close heating / cooling valve
	NO6	Outside damper	Electric heater	Open outside air damper
	NO7	Disabled	Bypass damper	Close outside air damper

Tab. 4.c



**Note:**

- The configurations corresponding to P91 = 44 and P91 = 45 require the expansion board with two 0 to 10 Vdc outputs (standard in the MasterAria electrical panel), while the configuration corresponding to P91 = 46 requires the expansion board with 4 triacs.
- Check that the corresponding inputs and outputs are enabled by dipswitch. For example, once having set P91=44, check that dipswitch 4=ON (see the previous paragraph).
- Once parameter 91 has been set, the individual settings for the specific application can be changed using the parameters corresponding to the inputs/outputs (see the following paragraphs).

### Identifying/setting the model of unit (parameter 124)

Once automatic configuration has been completed, make sure that MasterAria recognises the type of AHU being managed.

The main setting involves the type of AHU:

- 100% outside air;
- recirculation.

This is set using parameter P124:

**P124=0 AHU 100% outside air**

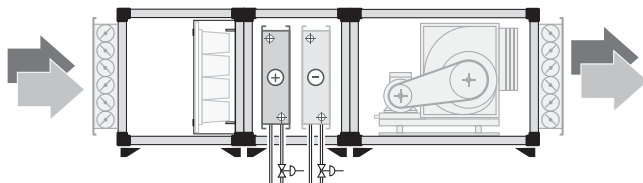


Fig. 4.b.a

The AHU with 100% outside air has just one air inlet, that is, from the outside, and the air in the environment is no recirculated. In this case, when MasterAria +030220481 - rel. 1.0 - 12.11.2007

the antifreeze alarm is active the controller stops the fan and switches off the optional electric heater.

**P124=1 AHU with recirculation**

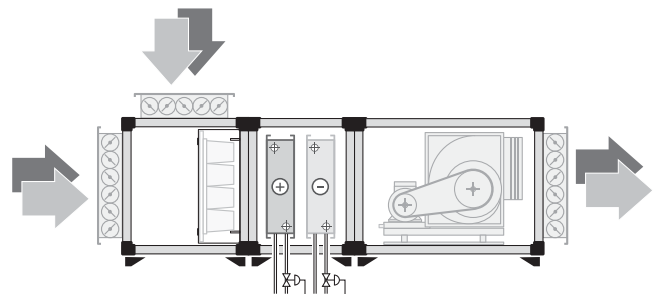


Fig. 4.b.b

In this case, the AHU, as well as taking in air from the outside, recirculated the air in the environment. The antifreeze function does not stop the fan and, if an electric heater is fitted, this is not switched off.



**Important:**

The incorrect configuration of this parameter may cause damage to the AHU!

### Configuration of an AHU with heating/cooling coil only (dipswitch 4 = OFF)

**- Configuration with P91=45**

MasterAria does not distinguish between coils for heating or cooling only and mixed coils.

The distinction is made by the user, by setting the proportional bands accordingly.

Par	Description	Def2
39	Configuration of output NO4	13 = Valve with 0 to 10 Vdc input for cold water (hot/cold water if dip4 = OFF)
40	Configuration of output NO5 (see P39)	21 = 0 to 10 Vdc outside damper
41	Configuration of output NO6 (see P39)	18 = Output (triac or relay) for man. of ON/OFF heaters (with hysteresis) on P+I. Set parameters P111, P112.
42	Configuration of output NO7 (see P39)	24 = ON/OFF recovery bypass damper

Tab. 4.d.a

If a modulating valve is used, operation is established by the parameters relating to the proportional bands.

In any case, dipswitch 4 must be OFF.

Coil model	Parameters
Heating/Cooling	P115=xx / P116=xx
Heating only	P115=0 / P116=xx
Cooling only	P115=xx / P116=0

Tab. 4.d.b

Par	Description	Def1	Def2	Def3	Min	Max	UOM
115	Proportional band for cooling valve	40	40	40	0	255	°C /10
116	Proportional band for heating valve	40	40	40	0	255	°C /10

### Configuration with electric heater

MasterAria can manage an electric heater with ON/OFF or proportional 0 to 10 Vdc control.

For configuration:

1. dipswitch 4 = OFF, if a 0 to 10 Vdc signal is used (AHU with 1 coil only, so the other output, NO4 or NO5, is not occupied);
2. dipswitch 5 = ON and configure the output with the parameters P39, P40, P41, P42.
3. Press the MODE button until the display shows the heater icon.

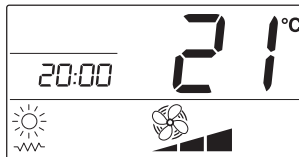


Fig. 4.c

**Important:** Outputs NO4 and NO5 are available for the modulating 0 to 10 Vdc heaters. Outputs NO6 and NO7 are available for ON/OFF heaters and have voltage-free contacts.

**Important:** During the antifreeze alarm, only in the case of AHUs with recirculation, the heater remains on until the temperature returns to normal values. This applies to the modulating 0 to 10 Vdc (P39=17) or ON/OFF heater (P39=18), but not the ON/OFF heater with option P39=6.

### Selecting the electric heater

#### ON/OFF heater

There are 2 possibilities:

- set P39=18 (or P40, P41, P42)  
Also set P111 (heater activation delta from set point) and P112 (hysteresis);
- set P41=6 (or P42)  
Also set P46 (heater activation delta from set point) and P13 (hysteresis).

#### Modulating heater

- Set P39 = 17 (or P40 =17);
- Set P111 = heater activation delta and P117 = heater proportional band.

### Probes

The reading of the probes is affected by their position due to the phenomenon of air stratification. To overcome this problem, offsets can be specified depending on the operating mode (heating or cooling). Faults with the control probe or the probe on one of the two heat exchangers cause the fan to stop and the valve to close. The control probe is selected by dipswitch.

It must be remembered that MasterAria performs control based on the room temperature (intake/return probe or sensor on the "acqua" terminal).

### Recommended configuration

probe	description	associated parameters	notes
B1	Intake-return probe/ Outside probe (compensation)	P22, P58, P59, P60	When DIP6 OFF & P22=0: room control probe.
B2	Heating coil probe	P62, P63	
B3	Cooling coil probe	P64, P65	
BT	Probe on terminal	P61	When DIP6 ON = room cont. probe.

Tab. 4.e.a

Prog	Description	Def1	Def2	Def3	Min	Max	UM
15	Function of probe B1	7	7	7	0	7	---
	0 use defined by dipswitch 6 & P22						
	1 probe disabled						
	2 heating/cooling coil probe						
	3 cooling coil probe						
	4 heating coil probe						
	5 control probe (intake/return)						
	6 outside probe						
	7 outlet probe						
16	Function of probe B2 (see P15)	4	2	2	4	7	---
17	Function of probe B3 (see P15)	6	6	6	0	7	---
22	Select optional compensation probe	0	0	0	0	2	---
	0 Compensation disabled						
	1 Compensation enabled on B1 = outside probe						
	2 Compensation enabled on B3 = outside probe						
58	probe B1 offset in cooling	0	0	0	-99	127	°C/10
59	probe B1 offset in heating	0	0	0	-99	127	°C/10
60	probe B1 offset in AUTOMATIC	0	0	0	-99	127	°C/10
61	probe BT offset from terminal	-30	-30	-30	-99	127	°C/10
62	probe B2 offset in cooling	0	0	0	-99	127	°C/10
63	probe B2 offset in heating	0	0	0	-99	127	°C/10
64	probe B3 offset in cooling	0	0	0	-99	127	°C/10
65	probe B3 offset in heating	0	0	0	-99	127	°C/10

Tab. 4.e.b

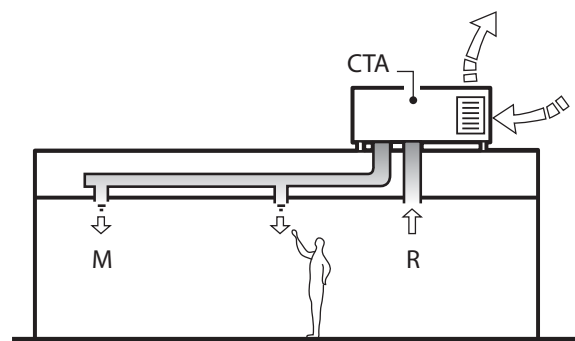


Fig. 4.d

Key:

AHU	air handling unit	R	intake/return
M	outlet		

### Digital inputs

Digital inputs DI1 and DI2 have a fixed configuration, while the others can be configured by parameter. The off status of digital input DI1 has priority over any incoming serial communication signals, so that the user (directly in contact with the flow of cold or hot air) can switch the MasterAria unit off.

Input	Description	Ass. pars.	Notes
DI1	ON/OFF input		when the input is closed the unit is switched to OFF status (even when there is no network connection). When switching OFF->ON, MasterAria is started however it can then be switched off from the terminal or via serial connection. In OFF status, the valve is closed and the fan is off (after any extra flush cycles required for the heater)
DI2	cooling/heating		Enabled when DIP2= ON
DI3	multifunction	P43	
DI4	multifunction	P44	
DI5	multifunction	P45	

Tab. 4.f.a

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
43	Configuration of digital input 3	10	10	10	0	14	---
	0 input disabled						
	1 economy (norm. open) (*)						
	2 window alarm (norm. open): stops the fan and closes the valve						
	3 DO NOT SELECT						
	4 DO NOT SELECT						
	5 local stop (generic alarm, norm. open): stops the fan and closes the valve						
	6 economy (norm.closed)						
	7 window alarm (norm. closed)						
	8 DO NOT SELECT						
	9 DO NOT SELECT						
	10 local stop (generic alarm, normally closed): stops the fan and closes the valve						
	11 enable antifreeze by time (normally open)						
	12 enable antifreeze by time (normally closed)						
	13 dirty filter alarm from differential pressure switch (normally open)						
	14 dirty filter alarm from differential pressure switch (normally closed)						
44	Configuration of digital input 4 (see P43)	12	12	12	0	14	---
45	Configuration of digital input 5 (see P43)	14	14	14	0	14	---

(\*) the "economy" function corresponds to the "sleep" function, however is activated by digital input.

Tab. 4.f.b



**Important:** avoid parameter settings that create situations of conflict (for example, do not configure two digital inputs on the same MasterAria as economy inputs).

### Procedure for testing the installation

Once the installation has been completed, the test procedure can be run to check the devices. The "acqua" terminal is required for these functions. To enter test mode press the UP and DOWN buttons for 10 seconds with the unit connected to the power supply and in OFF status; the event is signalled by the buzzer, which emits a beep.

The test proceeds in steps, indicated on the terminal by the message "L" followed by an incremental number; pressing the UP button proceeds to the next step (signalled by the BEEPING of the buzzer). After the last step, the procedure ends and the controller returns to normal operation.

step	part tested	message flashing	message not flashing
"L01"	probe B1	probe error	probe Ok
"L02"	probe B2	probe error	probe Ok
"L03"	probe B3	probe error	probe Ok
"L04"	digital input 1	input open	input closed
"L05"	digital input 2	input open	input closed
"L06"	digital input 3	input open	input closed
"L07"	digital input 4	input open	input closed
"L08"	digital input 5	input open	input closed
"L09"	fan		started at minimum speed, no internal test
"L10"	fan		started at medium speed, no internal test
"L11"	fan		started at maximum speed, no internal test
"L12"	output NO4		relay activated, voltage present (L). No internal test
"L13"	output NO5		relay activated, voltage present (L). No internal test
"L14"	output NO6		relay activated, contact closed. No internal test
"L15"	output NO7		relay activated, contact closed. No internal test

During operation (and during the test procedure), the device may generate alarm signals, which are displayed on the terminal.

Tab. 4.g

## 4.2 Control algorithms

**i** In summary

- general functions: Heat enable, Cool enable, Flush, Extra Flush, P+I temperature control, Freecooling, Freeheating, outlet limit control, fan management, Autofan or continuous fan operation.
- manual operation: cooling, heating (optional heater management), dehumidification, ventilation;
- automatic operation: heating (optional heater management) and cooling;
- set point compensation using outside probe;
- On/Off timer (1 time band) and "sleep" function;
- control of ON/OFF or modulating actuators.

Below is a description of the operation of MasterAria, divided into general functions, manual and automatic functions.

### Heat enable (heating/AUTOMATIC heating) (parameters 10,11,12,13)

In order to avoid undesired flows of cold air, the fan is only operated if the temperature of the main coil (e.g. probe B2) is high enough. If this condition is not satisfied the heating symbol (sun) flashes.

Par.	Description	Def1	Def2	Def3	Min	Max	UOM
P10	Temperature to enable minimum fan speed in heating/AUTOMATIC heating	29	29	29	0	255	°C
P11	Temperature to enable medium fan speed in heating/ AUTOMATIC heating	33	33	33	0	255	°C
P12	Temperature to enable maximum fan speed in heating/AUTOMATIC heating	37	37	37	0	255	°C
P13	-Hysteresis to enable fan in heating/AUTOMATIC heating, cooling, AUTOMATIC cooling -Heater hysteresis (P39=6)	10	10	10	0	255	°C/10
P55	Enable cooling & heating symbols in AUTOMATIC 0= symbols off 1= symbols on when called	0	0	0	0	1	---

Tab. 4.h.1

**!** Important:

The heat enable function must be disabled if modulating actuators are used (0 to 10 Vdc or 3-point).

### Cool enable (cooling/AUTOMATIC cooling, dehumidification) (parameters 13,14)

In order to avoid undesired flows of hot air, the fan is operated only if the temperature of the coil is low enough. If this condition is not satisfied the cooling symbol (snowflake) flashes. DIPSWITCH1 must be set to ON. The fan speed is managed by the control algorithms or set manually.

When reaching the set point, the hot/cold water or cold water valve only is closed and the fan is stopped.

Par.	Description	Def1	Def2	Def3	Min	Max	UOM
13	- Hysteresis to enable fan in heating/AUTOMATIC heating, cooling, AUTOMATIC cooling - Heater hysteresis (P39=6)	10	10	10	0	255	°C/10
14	Temperature to enable fan in cooling/ AUTOMATIC cooling e dehumidification	21	21	21	0	255	°C
55	Enable cooling & heating symbols in AUTOMATIC 0= symbols off 1= symbols on when called	0	0	0	0	1	---

Tab. 4.h.2

**!** Important: The cool enable function must be disabled if modulating actuators are used (0 to 10 Vdc or 3-point).

DIPSWITCH1 must be set to ON. The fan speed allowed (limiting the request by the control algorithm) is described in the following graph.

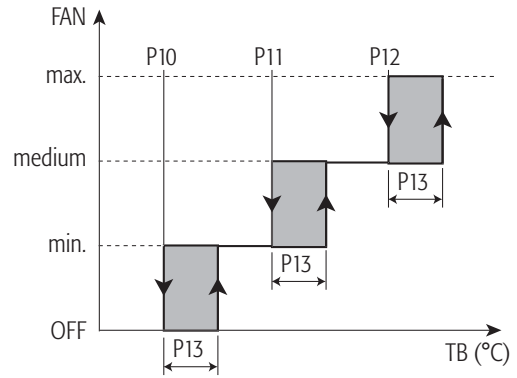


Fig. 4.e

Key  
FAN fan speed  
TB heating coil temperature

When reaching the set point, the hot/cold water or hot water valve only is closed and the fan is stopped.

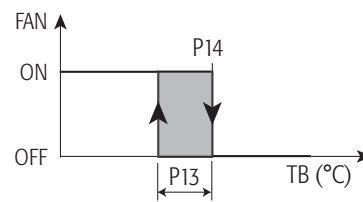


Fig. 4.f

Key  
FAN fan  
TB cooling coil temperature

**Flush (fan on/off cycles)**

(parameters 32,33,34)

**Note:** Function active only if the control probe is not probe BT on the "acqua" terminal.

To overcome the phenomenon of air stratification, MasterAria operates fan on/off cycles at minimum speed, even when the room temperature has reached the set point (the local/hot/cold valve remains closed). This helps ensure the correct measurement of the room temperature if the sensor on the acqua terminal is not used (e.g.: control probe = B1). The behaviour can be modified depending on the operating mode: heating, cooling, dehumidification or AUTOMATIC. The fan is started after a period of inactivity (due to the set point having been reached),

equal to the value of parameter P32.

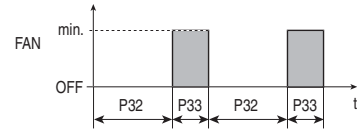


Fig. 4.g

**Key**  
FAN fan  
t time

Par.	Description	Def1	Def2	Def3	Min	Max	UOM
32	Flush off time	2	2	2	0	255	min
	0 Disabled >0 Fan off time						
33	Flush on time	90	90	90	0	255	s
	0 Disabled >0 Fan on time						
34	Flush mode	0	0	0	0	3	---
	0 Function disabled						
	1 Flush function active in cooling, dehumidification & AUTOMATIC						
	2 Flush function active in heating & AUTOMATIC OFF(*)						

AUTOMATIC OFF(\*)= unit in automatic mode and off because the temperature measured by the control probe is inside the dead band (P109) around the set point

Tab. 4.h.3

**Extra Flush**

(parameter 35)

**Note:** Function active only if the control probe is not probe BT on the "acqua" terminal.

This function ensures correct operation when the acqua terminal is not fitted (e.g.: control probe = B1), overcoming the phenomenon of air stratification.

Whenever switching from OFF->ON or changing operating mode, MasterAria runs a fan cycle at minimum speed (for the time P35) to make sure the room temperature is uniform. At the end of this interval, normal operation resumes. This is especially useful in the event of automatic operation.

**Manual fan speed setting**

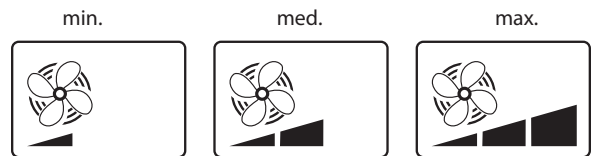


Fig. 4.i.a

**Automatic fan speed setting –AUTOFAN function** (see the corresponding paragraph)



Fig. 4.i.b

**Fan operating modes**

(parameter 118)

The MasterAria can manage 3 types of fan operation:

- **3 speed:** the fan stops when reaching the set point, (temperature measured by the control probe inside the dead band). In this mode, one of the three speeds (min., med., max.) can be set manually, by pressing the fan button, or alternatively AUTOFAN, with automatic management of the speed by the controller.

- **Minimum speed:** the fan only works at minimum speed, stopping when reaching the set point (control temperature inside the dead band, P109).
- **Constant single speed:** fan operating continuously at single speed, except in the event of alarms or when the AHU is shut down.

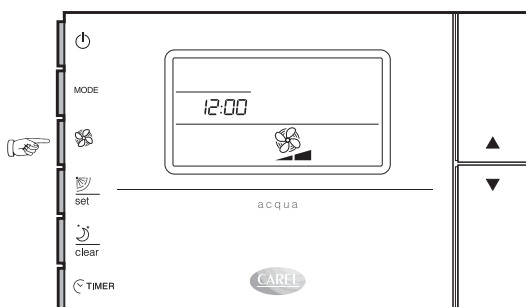


Fig. 4.h

Par	Description	Def1	Def2	Def3	Min	Max	U.M
118	Fan mode	2	2	2	0	2	---
	0 3 speed						
	1 minimum speed 2 continuous single-speed (normally used for AHUs)						

Tab. 4.h.4

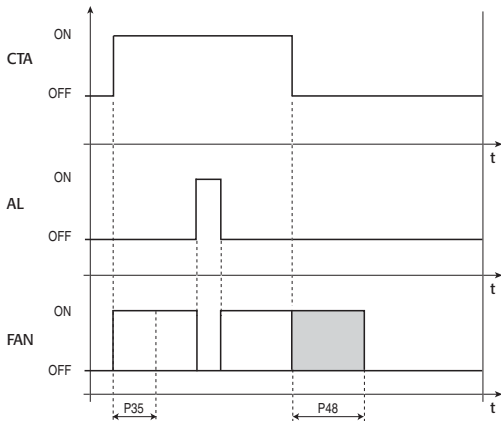


Fig. 4.i.c

Key:  
 AHU Air Handling Unit  
 AL shutdown alarm  
 FAN fan  
 t time

The part in grey of the fan graph indicates that extra flush is only performed if the electric heater was on before the AHU is shut down.

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
35	Flush time when changing mode	30	30	30	0	255	s
48	Extra flush time with heater	20	20	20	0	255	s

Tab. 4.h.5

**Autofan (fan speed selection based on the room temperature)**

(parameters 7,8,9,118)

Note: Function only active when P118=0

From the hardware point of view, the three speeds are managed by the three outputs NO1, NO2, NO3 on the MasterAria main control board. To activate the Autofan function, press the fan button on the "acqua" terminal until displaying AUTO next the fan icon. The Autofan function establishes the fan speed when there is no manual setting by the user. In cooling and heating mode, the speed is higher the further the room temperature is away from the set point (including AUTOMATIC cooling, AUTOMATIC heating). In ventilation mode, the speed is constant at the average value for the range set by parameters P30, P31, P06 (see the corresponding paragraph). In dehumidification mode, the speed is constant at the minimum value.

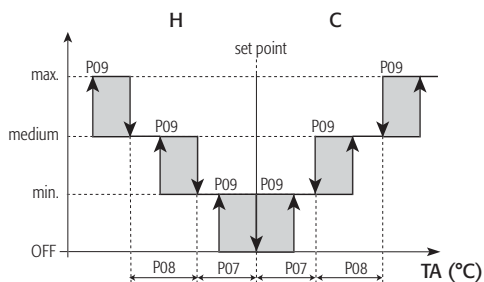


Fig. 4.j

Key  
 H heating  
 C cooling  
 TA room temperature (°C)

Par	Description	Def1	Def2	Def3	Min	Max	U.M
07	Medium speed delta in Auto Fan	7	7	7	0	255	°C/10
08	Maximum speed delta in Auto Fan	7	7	7	0	255	°C/10
09	Fan speed hysteresis in Auto Fan	5	5	5	0	255	°C/10
118	Fan mode	2	2	2	0	2	---
	0 3 speed						
	1 minimum speed						
	2 continuous single-speed (normally used for AHUs)						

Tab. 4.h.6

**Comfort (parameter 36)**

This function, if activated by P36, disables modification of the set point, allowing just a ±3 °C offset (in heating, cooling, dehumidification and AUTOMATIC mode). The set point can be set by serial connection (see the corresponding paragraph) or on the "acqua" terminal, for parameter P01.

Par	Description	Def1	Def2	Def3	Min	Max	UOM
36	Select AUTOMATIC with set point or Comfort	0	0	0	0	1	---
	0 Comfort function disabled (set point P01 can be changed from "acqua" terminal)						
	1 Enable Comfort (only ± 3°C change in set point from P01)						

**P and P+I algorithm (parameters 110,111,113,114,115,116,117)**

MasterAria features a P+I algorithm that is used to control modulating valves and dampers (0 to 10 Vdc and 3 point). Control can be performed on the BT probe on the "acqua" terminal or on the intake/return probe that can be assigned to one of the three MasterAria probes, by setting the corresponding parameter. The P+I algorithm is activated by enabling one of the modulating valve outputs and setting the proportional band and integration time parameters.

To start an actuator with a delay from the previous device, use the activation delta, which defines the point of activation of a device with reference to the previous. For example, to activate the cold water valve at set point + 4°C, simply set the cold water valve activation delta, P113=40 (the unit of measure is °C/10). The parameters for heating have a similar meaning.

The following events are defined, with the respective conditions for activation:

- OPENING:**
- room temperature increasing in cooling
  - room temperature decreasing in heating

- CLOSING:**
- room temperature decreasing in cooling
  - room temperature increasing in heating

When OPENING in heating, the activation sequence is: 1-Damper, 2-Heating valve, 3-Heater (\*). When OPENING in cooling the activation sequence is: 1-Damper, 2-Cold water valve

When CLOSING in heating the activation sequence is: 1-Heater(\*) 2-Heating valve, 3-Damper. When CLOSING in cooling the activation sequence is: 1-Cold water valve, 2-Damper.

This can be considered a LIFO sequence (Last In, First Out)

**Proportional control - P**

Below is a graph showing an example of configuration with proportional control only (integration time = P108=0) and the trend in the OPENING event.

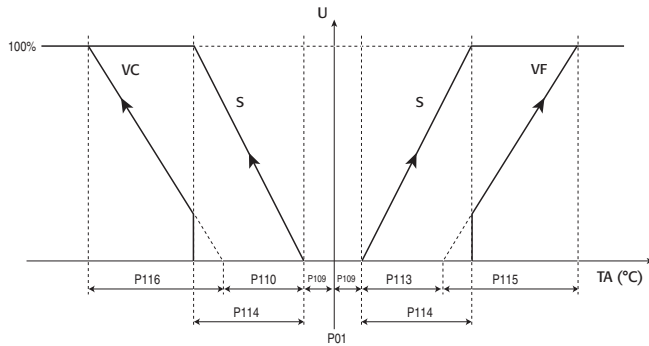


Fig. 4.k.a

**Key:**

P01 set point	U outputs
P109 dead band	TA room temperature (control probe)
P110 heating valve on delta	S outside damper
P113 cooling valve on delta	VF cooling valve
P114 damper prop. band	VC heating valve
P115 cooling valve prop. band	
P116 heating valve prop. band	

Note that:

- the control signal is sent to the actuators outside of the dead band
- the valve has a proportional band for heating and another for cooling
- the actuators are activated in sequence: first the damper, then the valve, which will begin opening outside of the damper proportional band, as illustrated in the figure.

In this case, the valve is activated when the damper is completely open, with a control signal corresponding to the percentage of opening at that point (>0%). As regards CLOSING, first the valve will close completely and then the damper will start closing, at a temperature equal to the complete closing temperature of the valve plus a  $\Delta T$  equal to two times the dead band:

$$\Delta T = 2 * P109$$

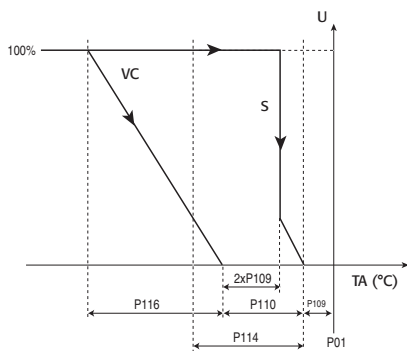


Fig. 4.k.b

**Key:**

P01 set point	U outputs
P109 dead band	TA room temperature (control probe)
P110 heating valve on delta	S outside damper
P113 cooling valve on delta	VC heating valve
P114 damper prop. band	
P116 heating valve prop. band	

The behaviour for closing in cooling is similar but opposite.

(\*) Note that as there are a maximum of two modulating 0 to 10Vdc outputs, the heater can be controlled with the P+I algorithm only if the damper is on/off. The activation delta and the proportional band are parameters P111 and P117.

**Proportional and integral control - PI**

If the integration time  $\neq 0$ , the P+I algorithm is implemented. The following graph shows the case of OPENING when the proportional band for the damper and the hot and cold water valves have the same value, with the activation delta set to zero.

OPENING IN HEATING:

- the actuators follow a ramp trend, without steps. When the damper is completely open, the valve starts opening gradually, as the error increases due to the contribution of the integration factor;

CLOSING IN HEATING:

- the valve starts closing when the room temperature exceeds point A. When the valve is completely closed, the damper starts closing, until reaching the minimum position (20%).

BEHAVIOUR IN THE DEAD BAND:

- around the set point ( $\pm P109$ ) the actuators stop at the position calculated when entering the dead band.

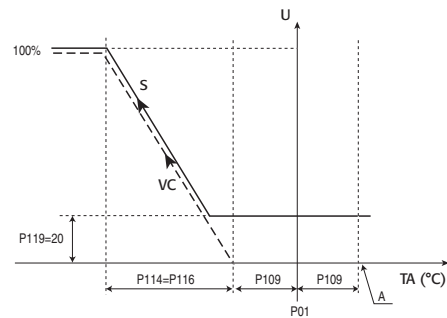


Fig. 4.k.c

**Key:**

P01 set point	U outputs
P109 dead band	TA room temperature (control probe)
P110 heating valve on delta	S outside damper
P113 cooling valve on delta	VC heating valve
P114 damper prop. band	
P116 heating valve prop. band	

The behaviour for opening and closing in cooling is similar but opposite.

**Actuator movement control (parameter 99)**

A parameter is available that limits the movements of the valve so as to reduce wear and adapt the P+I output to the effective resolution for the position of the actuator. In fact, a minimum variation in the P+I output can be established before the output effectively switches (parameter P99).

**Reduction in the effect of changing modes and/or operating parameters (bumpless transfer) (parameter 107)**

The "bumpless transfer" parameter, in response to changes in the P+I algorithm control parameters during the normal operation of the unit, dampens any swings or over-corrections of the system, especially when the algorithm interacts with multiple devices or actuators.

**Modulating valve/damper management (parameters 97,102,103)**

For modulating management of the actuators, parameters P15, P16, P17 must all be set >0.

For correct use of the 3-point actuators, the time taken for complete opening or closing must be entered.

Par	Description	Def1	Def2	Def3	Min	Max	UOM
97	3-point valve actuator travel time	120	120	120	1	255	s
102	Inactivity hysteresis If output < P102, output = 0 If output > 100% - P102, output = 100%	0	0	0	0	100	%
103	3-point damper actuator travel time	150	150	150	0	255	s

Tab. 4.h.8

**Synchronisation**

When the MasterAria is shutdown (switched from ON ->OFF), powered up, or when total closing is requested (in this case, the minimum time between two synchronisation cycles is 6 hours), a complete closing cycle is performed to ensure correct alignment between the position determined by the P-I algorithm and the real position, as there may in fact be misalignments due to mechanical wear after a significant number of operations. The synchronisation procedure is only performed on the 3 point valves, while for the valves with 0 to 10 V input, the function is managed by the electronics on the actuator. The return to normal operating conditions after a synchronisation cycle is managed according to the normal dynamics of the P-I algorithm, given that the extent of the error at the moment of synchronisation cannot be known. Small deviations between the theoretical and the actual position are automatically compensated for by the integration factor.

**Antistick function (parameters 100,101)**

To prevent the valves from blocking (due to impurities or the entrainment of solid residues in the water circuit), set movements of the valve are performed periodically. These operations are only performed after a certain period in which the valve is inactive (for example, when the set point has been reached or when the device is off). For the valves with 0 to 10 V input, this function is managed by the electronics on the actuator.

Par	Description	Def1	Def2	Def3	Min	Max	UOM
100	Maximum valve stationary time (to unlock) (0=antistick function disabled)	4	4	4	0	255	hrs
101	Forced movement for antistick. Considered as a % of the maximum travel set	20	20	20	0	100	%

Tab. 4.h.9

**Cooling (management of the hot/cold water or cold water valve only)**

The activation of the hot/cold water or cold water valve only is decided based on the set point (see the figure below), while the activation of the fan depends on the cool enable function (at the speed selected by the user or decided by the autofan function). When the room temperature (i.e. the value measured by the control probe) reaches the set point, the hot/cold water or cold water valve only is closed and the fan is stopped.

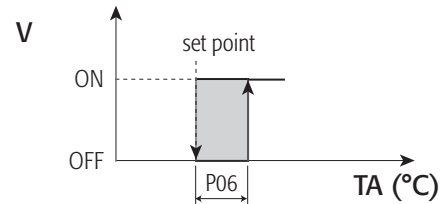


Fig. 4.l.a

**Key:**

- V valve
- TA room temperature (control probe)

Par	Description	Def1	Def2	Def3	Min	Max	UOM
06	Thermostat hysteresis	5	5	5	0	255	°C/10

Below is an example of the activation sequence of the MasterAria loads; the AHU is fitted with a hot/cold water valve and is operating in cooling mode with the fan speed established by the autofan function (control probe B1).

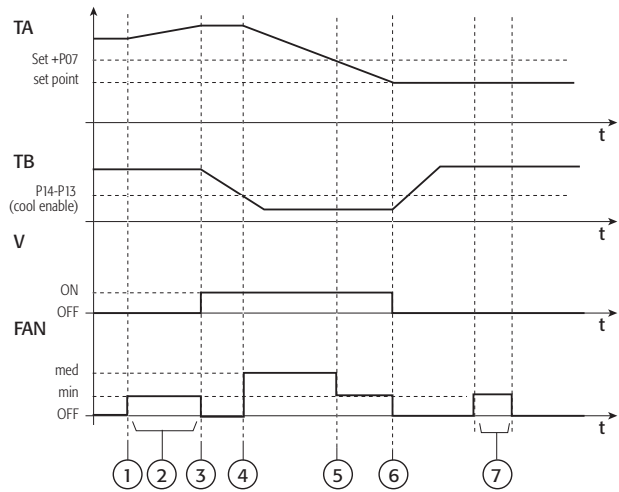


Fig. 4.l.b

**Key:**

- TA room temperature (probe B1)
- TB coil temperature (probe B2)
- V valve
- FAN fan
- 1. mode changed by user
- 2. extra flush cycle
- 3. select speed by autofan
- 4. activate ventilation by cool enable
- 5. change speed by autofan
- 6. deactivate valve & fan when set point reached
- 7. flush cycle
- t time

**Heating (management of the hot/cold water valve or hot water valve only)**

The activation of the hot/cold water or hot water valve only is decided based on the set point (see the figure below), while the activation of the fan depends on the heat enable function (at the speed selected by the user or decided by the autofan function).

When the room temperature (i.e. the value measured by the control probe) reaches the set point, the hot/cold water or hot water valve only is closed and the fan is stopped.

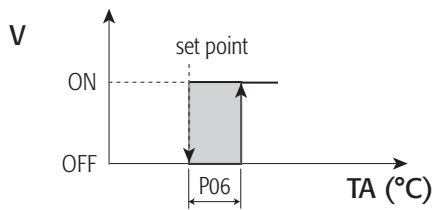


Fig. 4.m.a

Key:

- V valve
- TA room temperature (control probe)

Par	Description	Def1	Def2	Def3	Min	Max	UOM
06	Thermostat hysteresis	5	5	5	0	255	°C/10

A heater can be used (with dip 5= ON) to improve the heating function and establish a different hysteresis depending on whether or not the heat enable function is operating. To avoid possible overheating, the fan is started at the same time as the heater, and remains on for a time equal to P48 after the heater is shutdown. As extra protection, the heater is deactivated if the coil temperature exceeds the value of parameter P47.

Case 1: heat enable active (no hot water)

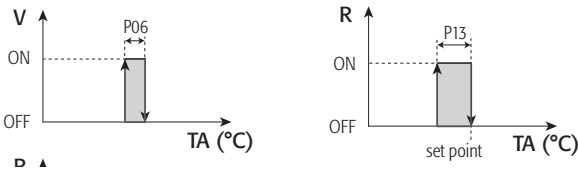


Fig. 4.m.b

Case 2: heat enable not active (hot water available)

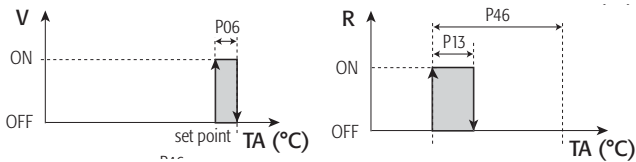


Fig. 4.m.c

Key

- R heater
- TA room temperature (control probe)
- V valve

Par	Description	Def1	Def2	Def3	Min	Max	U.M
13	- Hysteresis to enable fan in heat/heat AUTOMATIC, cool, cool AUTOMATIC - Heater hysteresis (P39=6)	10	10	10	0	255	°C/10
46	Heater band hysteresis (see P39=6)	30	30	30	0	255	°C/10
47	Max. coil temp. to deactivate heater (see P39=6)	40	40	40	0	255	°C
48	Extra flush time with heater	20	20	20	0	255	s

Tab. 4.h.10

Below is an example of the activation sequence of the MasterAria loads in heating mode; the AHU is fitted with a hot/cold water valve or hot water valve only and is operating in heating mode with the fan speed established by autofan.

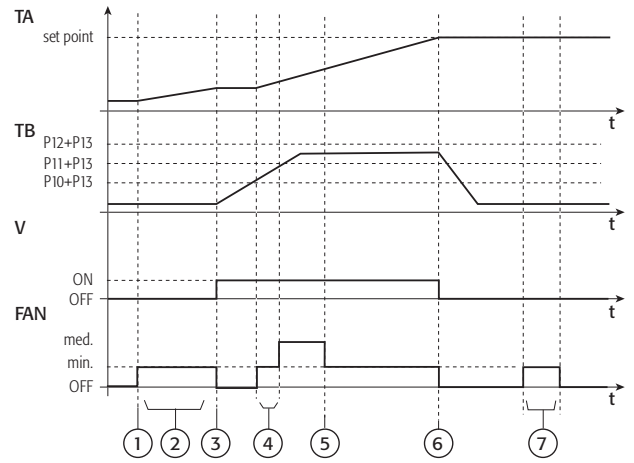


Fig. 4.m.d

Key

- TA room temperature (probe B1)
- TB coil temperature (heat enable)
- V valve
- FAN fan
- 1. mode changed by user
- 2. extra flush cycle
- 3. select speed by autofan
- 4. activate ventilation by heat enable & change speed
- 5. change speed by autofan
- 6. deactivate valve & fan when set point reached
- 7. flush cycle
- t time

Below is a further example of a unit fitted with hot/cold water valve or hot water valve only and heater; it is operating in heating mode with the fan speed established by autofan.

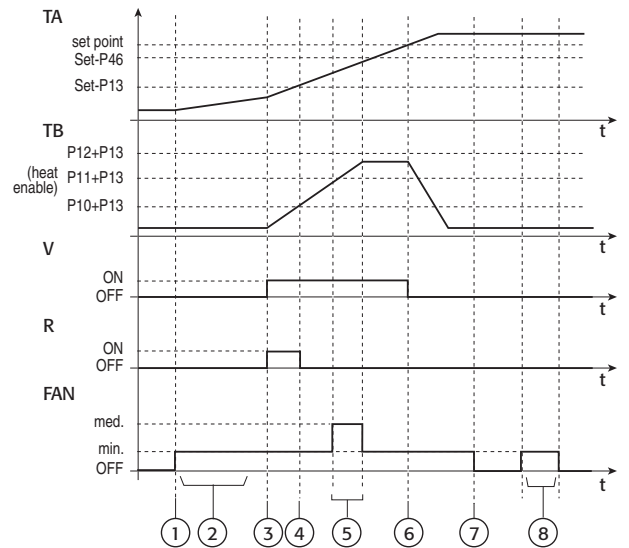


Fig. 4.m.e

Key

- TA room temperature (probe B1)
- TB coil temperature (heat enable)
- V valve
- R heater
- FAN fan
- 1. mode changed by user
- 2. extra flush cycle
- 3. activate valve & heater after extra flush
- 4. deactivate heater when thresh. exceeded w/ heat enable not active
- 5. speed by autofan
- 6. deactivate valve when set point reached
- 7. extra flush heater
- 8. flush cycle
- t time

**Dehumidification**

Based on the set point, firstly the room temperature is controlled, cooling if necessary, followed by the actual dehumidification cycle. In dehumidification mode, the hot/cold water valve or cold water valve only is always open, fan on/off cycles are run at minimum speed. The cool enable function is active so as to ensure that the exchanger temperature is low enough for the water vapour to condense. When the room temperature reaches the set point, the dehumidification cycle stops, the fan is shut down and the hot/cold water valve or cold water valve only is closed. If modulating actuators are used, the valve is controlled by opening or closing completely.

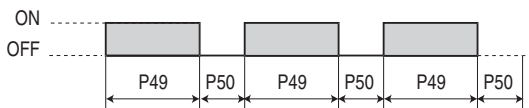


Fig. 4.n

Par	Description	Def1	Def2	Def3	Min	Max	UOM
49	Fan on time in dehumidification	3	3	3	0	255	min
50	Fan off time in dehumidification	15	15	15	0	255	min

Tab. 4.h.11

**Ventilation**

In this mode, the hot or cold water valve is always closed and the fan operates at the speed selected by the user (in autofan, it works at medium speed). The fan is only started if the room temperature is within the range of temperatures specified by parameters P30 and P31, to avoid undesired flows of hot or cold air.

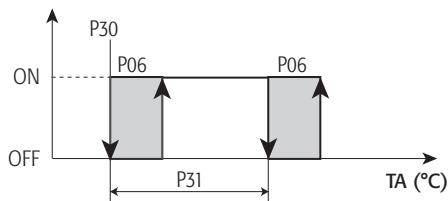


Fig. 4.o

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
06	Thermostat hysteresis	5	5	5	0	255	°C/10
30	Fan set point (Manual & AUTO)	15	15	15	0	255	°C
31	Fan differential (Manual & AUTO)	20	20	20	0	255	°C

Tab. 4.h.12

**Heater**

A heater can be managed for the pre-heating, heating and post-heating functions required by the application. If parameter 118≠2 (continuous fan operation), the fan is started at the same time as the heater, and remains on for a time equal to P48 after the heater shuts down. As further protection, the heater is deactivated if the coil temperature exceeds the value of parameter P47.

Par	Description	Def1	Def2	Def3	Min	Max	UOM
47	Max. coil temp. to deactivate heater (see P39=6)	40	40	40	0	255	°C
48	Extra flush time with heater	20	20	20	0	255	s

Tab. 4.h.13

See the description of P+I control for the meaning of the parameters

Par	Description	Def1	Def2	Def3	Min	Max	UOM
111	Heater activation delta	30	30	30	0	255	°C /10
117	Heater proportional band	0	0	0	0	255	°C /10

Tab. 4.h.14

**ON/OFF heater**

Two options are available for the ON/OFF heater, each with its own activation delta and hysteresis, depending on whether or not the P+I algorithm is activated.



**Important:**

During the antifreeze alarm, only for AHUs with recirculation, the heater is on until the temperature returns to normal values. This applies to the modulating 0 to 10 Vdc (P39=17) or ON/OFF heater (P39=18), and not the ON/OFF heater option P39=6.

**Case 1 (P+I algorithm activated): P39=18**

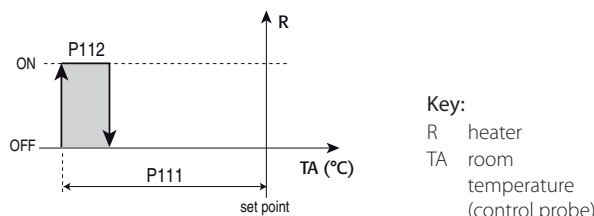


Fig. 4.p.a

Key:  
R heater  
TA room temperature (control probe)

Par	Description	Def1	Def2	Def3	Min	Max	UOM
39	Config. output NO4 18 Output (triac or relay) for man. of ON/OFF heaters (with hysteresis) on P+I. Set parameters P111, P112.	13	13	9	0	24	---
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---
42	Configuration of output NO7 (see P39)	0	24	20	0	24	---
111	Heater activation delta	30	30	30	0	255	°C /10
112	Heater hysteresis (p39=18)	5	5	5	0	255	°C /10

Tab. 4.h.15

**Case 2 (P+I algorithm NOT activated): P39 =6**

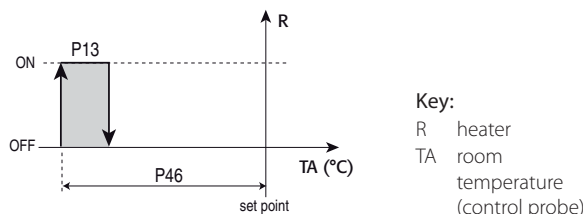


Fig. 4.p.b

Key:  
R heater  
TA room temperature (control probe)

**0 to 10 Vdc heater**

Par	Description	Def1	Def2	Def3	Min	Max	UOM
39	Config. output NO4 6  ON/OFF heater (normally open) (set parameters P46 & P13);	13	13	9	0	24	---
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---
42	Configuration of output NO7 (see P39)	0	24	20	0	24	---
13	Heater hysteresis (P39=6)	10	10	10	0	255	°C/10
46	Heater band hysteresis (see P39=6)	30	30	30	0	255	°C/10

Tab. 4.h.16

**AUTOMATIC operation:  
Heating/Cooling**

In AUTOMATIC mode, MasterAria measures the room temperature and decides which mode to activate (cooling or heating) based on the set point. The criterion is illustrated in the graph.

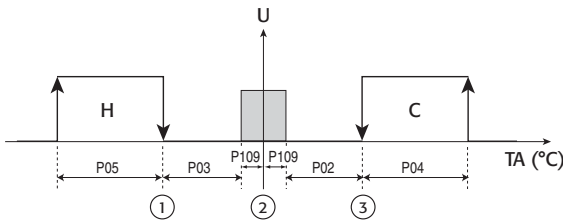


Fig. 4.q

<b>Key</b>			
H	heating	1.	cooling set point
C	cooling	2.	control set point
P109	dead band	3.	cooling set point
U	op. mode	TA	room temperature (cont. probe)

The fan and the cold/hot water valve are managed in the same way as in heating/cooling mode (the flush function is not active). The heater is managed in the same way as in heating mode. In AUTOMATIC OFF, the cold/hot water valve is closed and the flush function is active. If when entering AUTOMATIC mode the room temperature falls into the hysteresis zone, priority is given to heating mode. When cooling mode is activated, the control set point is the set point + P02, while in heating mode the control set point is the set point - P03.

**P+I ALGORITHM:** The mode, heating or cooling, is determined according to the graph shown on the side, then the P+I algorithm enters into play, managing the outputs. The mode is changed only after all the actuators have been deactivated, as a consequence the internal parameters are reset each time. It should be noted that P02, P03, P04 and P05 involve a further activation hysteresis (in addition to the P+I dead band) and therefore the parameters must be set appropriately. The values of parameters P04 and P05 should be set lower than the dead band.

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
02	AUTOMATIC mode: Set point differential in cooling	0	0	0	0	255	°C/10
03	AUTOMATIC mode: Set point differential in heating	0	0	0	0	255	°C/10
04	AUTOMATIC mode: Cooling hysteresis	0	0	0	0	255	°C/10
05	AUTOMATIC mode: Heating hysteresis	0	0	0	0	255	°C/10

Tab. 4.h.17

**Compensation using the outside temperature probe**

The set point can be adjusted in relation to the outside temperature, so as to avoid significant differences when entering/leaving the environment

**Case 1: Cooling**

If Text > Set + P23       $Set\_comp = Set + [(Text - (Set + P23)) * P24]$   
 If Text < Set + P23       $Set\_comp = Set$

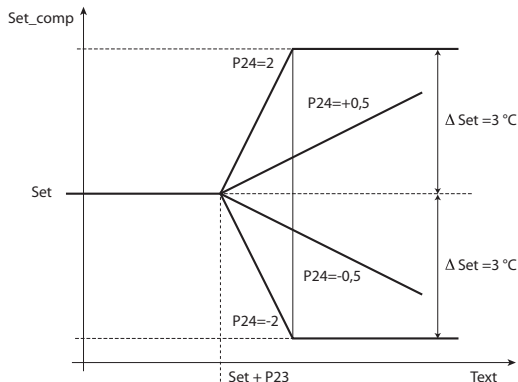


Fig. 4.r.a

or to compensate for the thermal dispersion of the environment itself. The parameters are differentiated between cooling and heating, and the coefficient applied may be positive or negative, depending on the desired effect.

**Case 1: Heating**

If Text > Set - P25       $Set\_comp = Set + [(Text - (Set - P25)) * P26]$   
 If Text < Set - P25       $Set\_comp = Set$

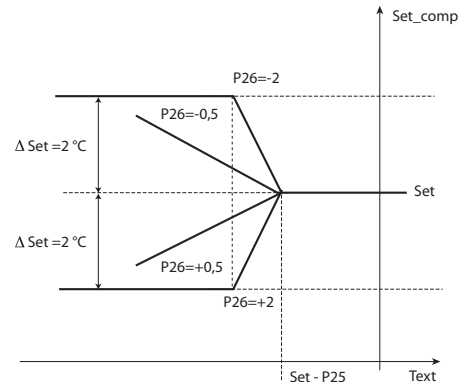


Fig. 4.r.b

<b>Key (Fig. 4.r.a &amp; Fig. 4.r.b)</b>	
Set	Set point
Set_comp	Set point with compensation
P23	Set point delta for compensation in cooling

P24	Factor for compensation in cooling
P25	Delta set point for compensation in heating
P26	Factor for compensation in heating
Text	Outside temperature

The set point with compensation cannot in any case exceed values greater than or less than 3 °C (cooling) and 2 °C (heating) from the set point (saturation).

Par	Description	Def1	Def2	Def3	Min	Max	UOM	
22	Select optional compensation probe	0	0	0	0	2	---	
	0							Compensation disabled
	1							Compensation enabled on B1 = outside probe
	2	Compensation enabled on B3 = outside probe						
23	Set point delta for compensation in cooling (0 = Compensation disabled)	0	0	0	-99	127	°C/10	
24	Factor for compensation in cooling (0 = Compensation disabled)	0	0	0	-20	20	---	
25	Set point delta for compensation in heating (0 = Compensation disabled)	0	0	0	-99	127	°C/10	
26	Factor for compensation in heating (0 = Compensation disabled)	0	0	0	-20	20	---	

Tab. 4.h.18

### 4.3 Outlet limits

Outlet limits are particularly useful in applications where the AHU is controlled based on the return (intake) or room temperature, and have the purpose of preventing air that is too cold or too hot from being introduced into the environment. To do this, these limits act directly on the heating and cooling devices, bypassing the other algorithms.

#### Minimum outlet limit on the cold water valve

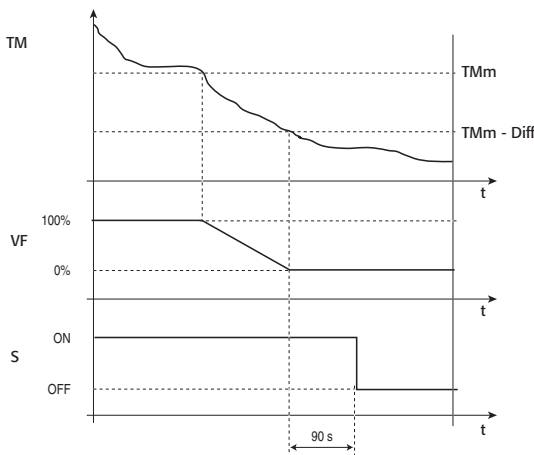


Fig. 4.s

**Key**  
 t time  
 VF cooling valve  
 S damper  
 TM outlet temperature  
 TmM min outlet temp. (P106)  
 Diff outlet limit diff. (P126)

- Cold water valve:** when the outlet temperature falls below the minimum outlet temperature (TmM), MasterAria starts closing the cold water valve until closing completely at the value of (TmM-Diff).
- Outside damper:** if a modulating damper is used and freecooling/heating management is available, the outlet limit acts on the damper only if the action on the cooling coil is not sufficient. If 90 seconds after closing the valve the outlet temperature continues to remain below the minimum outlet temperature minus a differential, the damper is moved to the minimum position (P119). For ON/OFF dampers, the damper is closed.

While the outlet limit conditions remain, the integral action of the control algorithm is suspended.

Par	Description	Def1	Def2	Def3	Min	Max	UOM
106	Minimum cooling valve/heating valve-heater outlet temperature	127	18	18	-28	127	°C
119	Minimum outside damper position	0	20	20	0	100	%
126	Outlet limit differential	20	20	20	10	255	°C/10

Tab. 4.i

#### Minimum outlet limit on the hot water valve (heating

only)

During the winter period, there are two cases in which the minimum outlet limit may be enabled:

- when the room temperature reaches the set point and the heating coil closes completely, if the outside air is too cold a situation of discomfort will be created inside the environment near the air distributors;
- when freecooling is active in crowded environments such as discos, pubs etc., if the outside air is too cold the same problem as described above occurs.

In these cases, to speed up the correction, the heating coil needs to be activated by the outlet probe.

Depending on the heating devices used, the following actions are implemented:

- Heating valve:** when the outlet temperature falls below the minimum outlet temperature (TmM), MasterAria starts opening the heating valve until opening completely at the value of (TmM-Diff).
- Modulating heater only:** same operation as for the modulating valve.
- ON/OFF heater only:** as shown in the graph, if the only heating device is the ON/OFF heater, then it switches on at (TmM - Diff).

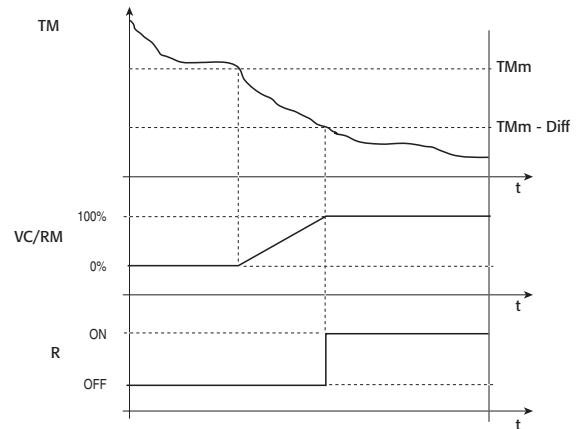


Fig. 4.t

**Key**  
 t time  
 VC/RM mod. heating valve/heater  
 R ON/OFF heater  
 TM outlet temperature  
 TmM min outlet temp. (P106)  
 Diff outlet limit diff. (P126)

Par	Description	Def1	Def2	Def3	Min	Max	UOM
106	Minimum cooling valve/heating valve-heater outlet temperature	127(*)	18	18	-28	127	°C
126	Outlet limit differential	20	20	20	10	255	°C/10

Tab. 4.j

(\*) 127 = function disabled

#### Maximum outlet limit

This limit is implemented when the AHU is working in heating mode and due to sudden variations in the outside environmental conditions or faults

on the unit, air that is too hot starts being blown into the environment. In this case, MasterAria starts reducing the action of the heating coil.

Depending on the heating devices used, the following actions are implemented:

1. **Heating valve:** when the outlet temperature exceeds the maximum outlet temperature (TMM), MasterAria starts closing the heating valve until closing completely at the value of (TMM+Diff).
2. **Modulating electric heater:** same operation as for the heating valve.
3. **Heating valve + ON/OFF heater:** first the heater is switched off and then the valve closes.
4. **Outside damper:** if a modulating damper is used and freecooling/heating management is available, the outlet limit acts on the damper only if the action on the heating coil is not sufficient. If 90 seconds after closing the valve the outlet temperature continues to remain above the maximum outlet temperature plus a differential, the damper is moved to the minimum position (P119). For ON/OFF dampers, the damper is closed.

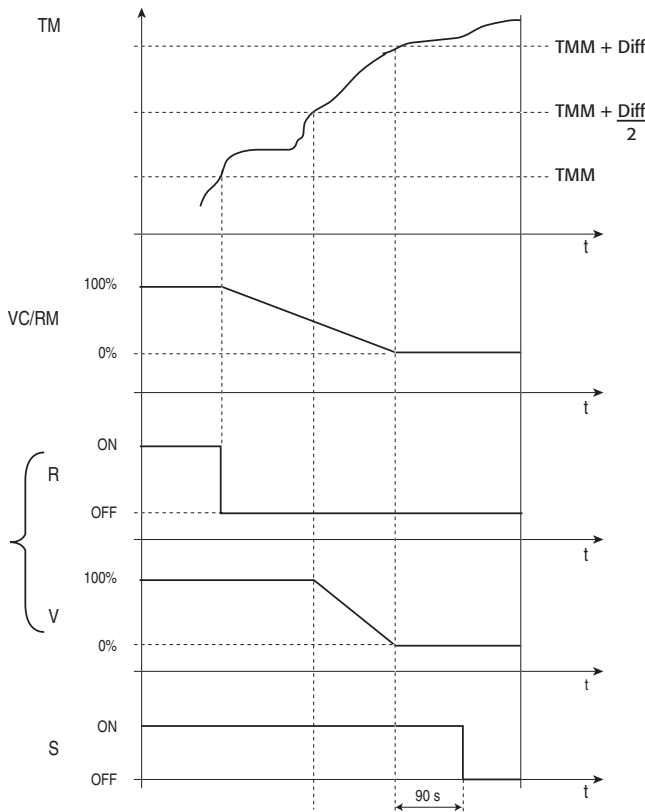


Fig. 4.u

- Key**
- t time
  - V heating valve
  - R ON/OFF heater
  - S damper
  - TM outlet temperature
  - TMM max. outlet temp.
  - Diff outlet limit diff.
  - VC/RM modulating heating valve/heater

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
125	Maximum outlet temperature	127 (*)	28	28	-28	127	°C
126	Outlet limit differential	20	20	20	10	255	°C/10

Tab. 4.k

(\*) 127 = function disabled

### Freecooling/freeheating dampers

MasterAria can manage the outside air damper, the recirculation damper and the heat recovery unit bypass damper. The first two dampers have complementary behaviour and can be managed by the same output with a parallel connection. The actuators have a selector for reversing the direction of rotation. For convenience, reference will only be made to the outside air damper. The type of management can be on/off or proportional.

### ON/OFF damper

The management of these types of dampers is quite simple. The behaviour of the damper is in fact very similar to the AHU itself, as can be seen from the graph. Note the extra flush cycle if the electric heater is fitted.

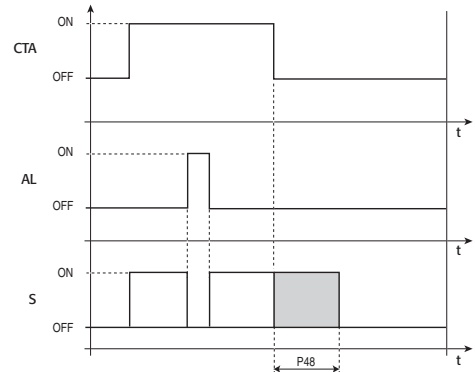


Fig. 4.v

- Key:**
- AHU air handling unit
  - AL antifreeze alarm
  - S damper
  - t time

Par	Description	Def1	Def2	Def3	Min	Max	UOM
39	Config. output NO4 23 ON/OFF outside damper	13	13	9	0	24	---
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---
48	Extra flush time with heater	20	20	20	0	255	s

Tab. 4.l

### Proportional 0 to 10 Vdc damper

MasterAria manages the proportional damper using the P+I control algorithm, described in the corresponding paragraph.

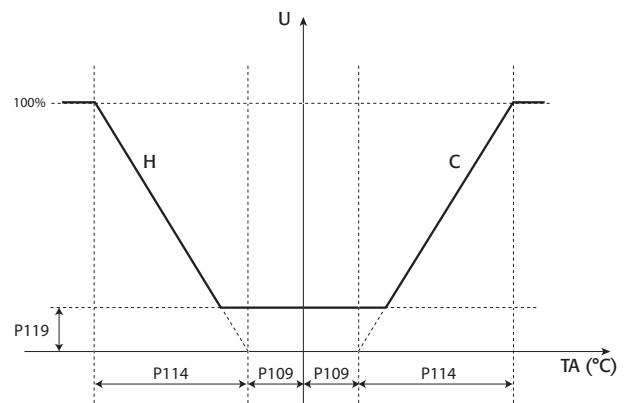


Fig. 4.w

- Key:**
- P114 damper prop. band

U	P+I output	H	heating
P109	dead band	C	cooling
P119	minimum damper position	TA	room temperature (control probe)

The proportional damper features a minimum position, set by the user (P119), below which the damper cannot be closed, except in the event of alarms.

It is opened beyond the minimum position if the freecooling and freeheating conditions require.

### Freecooling and freeheating

The freecooling/freeheating function is used to exploit the outside temperature conditions, when these are favourable, adjusting the opening of the outside damper.

To be able to use these functions:

- connect and enable the outside and room temperature probes;
- set the freecooling differential;
- set the freeheating differential.

In the summer period, the conditions to allow freecooling are:

$$T_{\text{Room}} - T_{\text{OUTSIDE}} > \text{Freecooling activation delta (P104)}$$

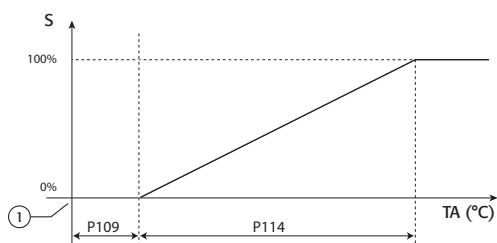


Fig. 4.x.a

Key:

- S outside damper
- TA room temperature (control probe)
- 1. set point

If the condition is satisfied, then the damper starts opening according to the normal control signal, based on the control probe reading.

In the winter period, the conditions to allow freeheating are:

$$T_{\text{OUTSIDE}} - T_{\text{Room}} > \text{Freeheating activation delta (P105)}$$

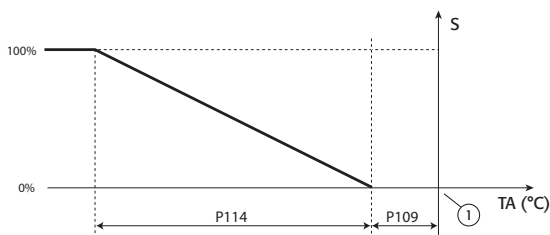


Fig. 4.x.b

Key:

- S outside damper
- TA room temperature (control probe)
- 1. set point

If the condition is satisfied, then the damper starts opening according to the normal control signal, based on the control probe reading.

**Disabling:** To disable the freecooling and freeheating functions, set the respective differentials to zero (parameters P104 and P105).

Prog.	Description	Def1	Def2	Def3	Min	Max	UOM
15	Function of probe B1 6 Outside probe	7	7	7	0	7	---
16	Funct. probe B2 (par. table)	4	2		4	7	---
17	Funct. probe B3 (par. table)	6	6	6	0	7	---
39	Config. output NO4	13	13	9	0	24	---
19	Open 3-point outside damper						
20	Close 3-point outside damper						
21	0 to 10 Vdc outside damper						
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---
42	Configuration of output NO7 (see P39)	0	24	20	0	24	---
104	Freecooling activation delta	0	20	20	0	255	°C/10
105	Freeheating activation delta	0	20	20	0	255	°C/10

Tab. 4.m

### Heat recovery unit

The MasterAria can manage cross-flow heat recovery units, with the corresponding bypass damper. The heat recovery unit is an excellent device for ensuring energy saving, as it exploits the air discharged from the environment to heat (in heating mode) or cool (in cooling mode) the outside air taken in by the AHU.

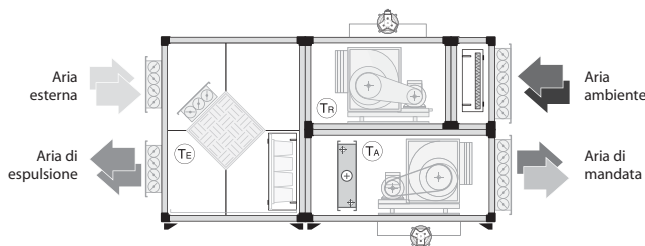


Fig. 4.y.a

The role of the bypass damper is to bypass the heat recovery unit when the outside and room temperatures would not allow good heat recovery.

Normally, the heat recovery unit is bypassed when the outside conditions are favourable, that is, when freecooling or freeheating are active. MasterAria can only manage on/off actuators in this case ON/OFF.

#### Operation:

##### Cooling

If cooling is required, the bypass damper only closes if:  $(T_{\text{OUTSIDE}} - T_{\text{ROOM}}) > P127$

##### Heating

If heating is required, the bypass damper only closes if:  $(T_{\text{ROOM}} - T_{\text{OUTSIDE}}) > P127$

Both conditions are maintained for a minimum of 5 minutes, to avoid situations of instability when the temperature fluctuates around the set point.

##### Antifreeze

If the antifreeze conditions are true, MasterAria opens the bypass damper.

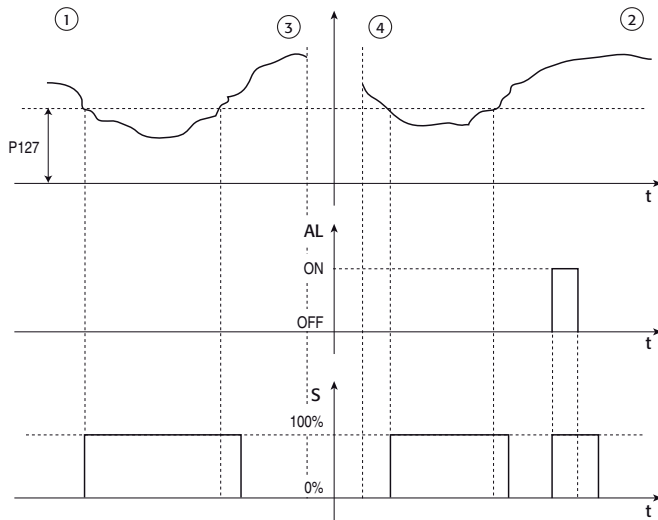


Fig. 4.y.b

- Key**
- 1. cooling
  - 2. heating
  - 3.  $T_{OUTSIDE} - T_{ROOM}$
  - 4.  $T_{ROOM} - T_{OUTSIDE}$
  - t time
  - AL antifreeze alarm
  - S recovery bypass damper

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
15	Function of probe B1 6 Outside probe	7	7	7	0	7	---
16	Function of probe B2 (see par. table)	4	2		4	7	---
17	Function of probe B3 (see par. table)	6	6	6	0	7	---
39	Config. output NO4 24 ON/OFF recovery bypass damper	13	13	9	0	24	---
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---
42	Configuration of output NO7 (see P39)	0	24	20	0	24	---
127	Close bypass damper set point	20	20	20	0	255	°C/10

Tab. 4.n

### 4.3 Notes on settings via serial connection

All the MasterAria parameters can be viewed and those without write protection modified via serial connection (PlantVisor and Modbus®). Below is a short description of the most significant variables (for the settings, see the summary table of parameters).

Variable	Meaning	Type	SV ind	Modbus® ind	R/W
Control probe	This variable contains the value of the probe used to control the MasterAria (B1 or BT). The value considers any offsets, hysteresis, control algorithms etc.	A	74	74	R
Set point setting	This variable is used to read and where necessary overwrite the value of the set point configured on the panel. This is especially useful if the MasterAria has the comfort function active (e.g. centralised systems such as hotels, offices etc.).	I	83	211	R/W
Control set point	This variable is used to read the value of the control set point used by MasterAria. The value considers the hysteresis, compensation factors, offsets (e.g.: sleep function), algorithms etc.	A	76	76	R
Digital inputs & heat/cool request	Heating/cooling signal: the bits are set when the unit is ON and the set point has not been reached. Especially useful for energy saving functions.	I	81	209	R
Lock keypad from panel	This variable is used to disable the buttons on the terminal so as to prevent accidental settings. Useful for centralised systems (hotels, offices etc.).	I	78	206	R/W do not modify

Tab. 4.o

### 4.4 Alarms

Below is the table of alarms.

Alarm	Display	Effect	Notes	Priority
Eeprom fault on power up	A01	Stop fan (with extra flush for heater). Close hot/cold water valves. Switch off heater.	Load defaults or reset from key	1
Slave offline in CAN network	A02			2
Room probe fault	A03			3
Probe B2 or B3 fault	A04			4
Window alarm A05	A05			5
Circulating pump stopped	A06			6
Local stop	A07			7
Antifreeze alarm	A08	<b>AHU 100% outside air:</b> <ul style="list-style-type: none"> <li>• Stop fan (after optional extra flush with heater)</li> <li>• Close outside damper</li> <li>• Open heating valve</li> <li>• Open cooling valve when no heating valve</li> </ul> <b>AHU with recirculation:</b> <ul style="list-style-type: none"> <li>• Fan operating</li> <li>• Close outside damper</li> <li>• Activate heating device (heater or valve)</li> <li>• Open cooling valve, with no heating valve or heater</li> <li>• Open bypass damper</li> </ul>		8
Dirty filter alarm	A09	Signal only on terminal		9

Tab. 4.p

### Fan circuit breaker

To ensure both software and electromechanical protection, as shutting down the fan implies stopping the entire unit, the fan circuit breaker

should be connected directly to the digital input configured as the local stop. In this case, MasterAria deactivates the fan output and closes the valve.

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
43	Configuration of digital input 3	10	10	10	0	14	---
	5   local stop (normally open)						
	10   local stop (normally closed)						
44	Configuration of digital input 4 (see P43)	12	12	12	0	14	---
45	Configuration of digital input 5 (see P43)	14	14	14	0	14	---

Tab. 4.q

The alarm is indicated on the display by code A07.

### Dirty filter alarm

By nature, the filters on an AHU will become clogged with all the impurities present in the air.

When the filters are excessively clogged, not only do they no longer carry out their filtering function, but they also represent a significant pressure drop for the AHU. To warn the user of this risk, MasterAria manages the dirty filter alarm.

The signal that generates the alarm is sent by the digital pressure switch that measures the pressure difference upstream and downstream of the filter. If the pressure difference exceeds the threshold set by a trimmer in the pressure switch, the contact opens, generating the alarm. The alarm is signal-only, and does not affect the normal operation of the AHU in any way.

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
43	Configuration of digital input 3	10	10	10	0	14	---
	13   dirty filter alarm from differential pressure switch (normally open)						
	14   dirty filter alarm from differential pressure switch (normally closed)						
44	Configuration of digital input 4 (see P43)	12	12	12	0	14	---
45	Configuration of digital input 5 (see P43)	14	14	14	0	14	---

Tab. 4.r

The alarm is indicated on the display by code A09.

### Antifreeze alarm

The condition that causes the antifreeze alarm is very critical for an AHU, as it may cause irreparable damage to the water coils and the heat recovery unit. The antifreeze alarm can be activated by probe (P121, P122=activation threshold, deactivation threshold) or by thermostat.

MasterAria, when managing an antifreeze situation, distinguishes the type of AHU: 100% outside air or recirculation (P124).

 **Important: parameter P124 must be set correctly!**

#### AHU with 100% outside air

This unit only has the outside damper and not the recirculation damper. This means that the AHU only works with the air only coming in from the outside.

In the event of antifreeze alarms, MasterAria responds as follows:

- closes the outside air damper;
- stops the fan;
- operates the heating device at 100%, unless the electric heaters are being used, which are kept off or switched off if on;
- if there are no heating devices or there are only electric heaters, the cold water valve is fully opened to see whether this can prevent the coil from freezing;
- the display shows the alarm A08.

#### AHU with recirculation

This unit has both the outside damper and the recirculation damper. This means that the air coming in from the outside and the air from the environment are mixed inside the AHU.

In the event of antifreeze alarms, MasterAria responds as follows:

- closes the outside air damper;
- completely opens the recirculation damper;

- the fan is kept on;
- operates the heating device at 100%, with priority given to the heater if fitted, otherwise the heating valve;
- if there are no heating devices, the cold water valve is fully opened to see whether this can prevent the coil from freezing;
- the display shows the alarm A08;;

#### AHU with heat recovery unit

The ON/OFF damper on the heat recovery unit is opened during the antifreeze alarm. In systems with P91=45, the behaviour of the fan, heater and valve is the same as for the AHU with 100% outside air (P124 = 0).

#### Return to normal operation

In the cases described above, the AHU automatically returns to normal operation when the temperature measured by the probe returns to normal values or when the thermostat contact opens.

There is in any case a programmable delay (P123) that controls the return to normal operation.

Prog	Description	Def1	Def2	Def3	Min	Max	UOM
15	Function of probe B1	7	7	7	0	7	---
	3   Cooling coil probe						
	4   Heating coil probe						
16	Function of probe B2 (see P15)	4	2		4	7	---
17	Function of probe B3 (see P15)	6	6	6	0	7	---
43	Configuration of digital input 3	10	10	10	0	14	---
	11   enable antifreeze by time (normally open)						
	12   enable antifreeze by time (normally closed)						
44	Configuration of digital input 4 (see P43)	12	12	12	0	14	---
45	Configuration of digital input 5 (see P43)	14	14	14	0	14	---
120	Enable antifreeze	0	2	2	0	2	---
	0   Disabled						
	1   Enable by probe						
	2   Enable by digital input						
121	Antifreeze activation threshold	2	2	2	-28	50	°C
122	Antifreeze deactivation threshold	7	7	7	-28	50	°C
123	Antifreeze time	2	2	2	1	255	min
124	Unit model	0	1	1	0	1	---
	0   100% outside air						
	1   With recirculation						

Tab. 4.5

## 4.5 Table of parameters

P	Parameter	Def.1	Def.2	Def.3	Min	Max	UOM	SV type	SV #	Modbus®	access	notes
00	Software version	---	---	---	---	---	---	I	1	129	U	E.g.10 = v1.0
01	AUTOMATIC mode set point	22	22	22	0	255	°C	A	1	1	U	
02	AUTOMATIC mode: Set point differential in cooling	0	0	0	0	255	°C/10	A	2	2	U	
	AUTOMATIC mode: Set point differential in heating	0	0	0	0	255	°C/10	A	3	3	U	
04	AUTOMATIC mode: Cooling hysteresis	0	0	0	0	255	°C/10	A	4	4	U	
05	AUTOMATIC mode: Heating hysteresis	0	0	0	0	255	°C/10	A	5	5	U	
06	Thermostat hysteresis	5	5	5	0	255	°C/10	A	6	6	U	
07	Delta for medium speed in Autofan	7	7	7	0	255	°C/10	A	7	7	U	
08	Delta for maximum speed in Autofan	7	7	7	0	255	°C/10	A	8	8	U	
09	Fan speed hysteresis in Autofan	5	5	5	0	255	°C/10	A	9	9	U	
10	Temperature to enable minimum fan speed in heating/ AUTOMATIC heating	29	29	29	0	255	°C	A	10	10	U	
11	Temperature to enable medium fan speed in heating/ AUTOMATIC heating	33	33	33	0	255	°C	A	11	11	U	
12	Temperature to enable maximum fan speed in heating/ AUTOMATIC heating	37	37	37	0	255	°C	A	12	12	U	
13	- Hysteresis to enable fan in heating/AUTOMATIC heating, cooling, AUTOMATIC cooling	10	10	10	0	255	°C/10	A	13	13	U	
	- Heater hysteresis with heat enable active (P39=6)											
14	Temperature to enable fan in cooling/AUTOMATIC cooling & dehumidification	21	21	21	0	255	°C	A	14	14	U	
15	Function of probe B1	7	7	7	0	7	---	I	105	233	U	
	0   With dipswitch6 = ON, control probe is probe on "acqua" terminal											
	1   Probe disabled											
	2   Heating/cooling coil probe											
	3   Cooling coil probe											
	4   Heating coil probe											
	5   With dipswitch6 = OFF, control probe is probe B1 (intake/return)											
	6   Outside probe											
7   Outlet probe												

P	Parameter	Def.1	Def.2	Def.3	Min	Max	UOM	SV type	SV #	Modbus®	access	notes
16	Function of probe B2 (see P15)	4	2	2	0	7	---	I	106	234	U	
17	Function of probe B3 (see P15)	6	6	6	0	7	---	I	107	235	U	
18	Increase cooling/dehumidification set point in sleep	10	10	10	0	255	°C/10	A	18	18	U	
19	Decrease heating set point in sleep	10	10	10	0	255	°C/10	A	19	19	U	
20	ADC limitation coefficient	6	6	6	0	15	---	I	2	130	U	
21	ADC average coefficient	6	6	6	0	15	---	I	3	131	U	
22	Select optional compensation probe	0	0	0	0	2	---	I	4	132	U	
	0 Compensation disabled											
	1 Compensation enabled on B1=outside probe											
	2 Compensation enabled on B3=outside probe											
23	Set point delta for compensation in cooling	0	0	0	-99	127	°C/10	A	20	20	U	
	0 Compensation disabled											
24	Factor for compensation in cooling	0	0	0	-20	20	---	A	21	21	U	
	0 Compensation disabled											
25	Set point delta for compensation in heating	0	0	0	-99	127	°C/10	A	22	22	U	
	0 Compensation disabled											
26	Factor for compensation in heating	0	0	0	-20	20	---	A	23	23	U	
	0 Compensation disabled											
28	Visibility of output values to supervisor	0	0	0	0	3	---	I	6	134	U	
	0 Disabled											
	1 Enabled											
	2,3 DO NOT SELECT											
30	Fan set point (Manual & AUTO)	15	15	15	0	255	°C	A	24	24	U	
31	Fan differential (Manual & AUTO)	20	20	20	0	255	°C	A	25	25	U	
32	Flush off	2	2	2	0	255	min	I	8	136	U	
	0 Disabled											
	>0 Fan off time											
33	Flush on	90	90	90	0	255	s	I	9	137	U	
	0 Disabled											
	>0 Fan on time											
34	Flush mode	0	0	0	0	3	---	I	10	138	U	
	0 Function disabled											
	1 Flush function active in cooling, dehumidification & AUTOMATIC											
	2 Flush function active in heating & AUTOMATIC OFF											
	3 Flush function active in heating, cooling, dehumidification & AUTOMATIC OFF											
35	Flush time when changing mode	30	30	30	0	255	s	I	11	139	U	
36	Select AUTOMATIC with Set point or Comfort	0	0	0	0	1	---	I	12	140	U	
	0 Comfort function disabled (set point can be changed from "acqua" terminal)											
	1 Enable Comfort (only ±3 °C change in set point from P01)											
37	Display ("acqua" terminal)	0	0	0	0	5	---	I	13	141	U	
	0 Display set point											
	1 Display control probe (BT or B1)											
	2 Display probe B2											
	3 Display probe B3											
	4 Display position of modulating valve											
	5 Display position of modulating damper											
38	Disable operating mode	0	0	0	0	255	---	I	14	142	U	
	1 AUTOMATIC											
	2 cooling											
	4 dehumidification											
	8 ventilation											
	16 heating											
	32 autofan											
	64 sleep											
	128 ON/OFF timer & display clock											
	The setting is achieved by adding the values shown below, each of which corresponds to the disabling of the corresponding function.											
	EXAMPLE:											
	Activation of AUTOMATIC mode only: 2+4+8+16 = 30											

P	Parameter	Def.1	Def.2	Def.3	Min	Max	UOM	SV type	SV #	Modbus®	access	notes
39	Configuration of output NO4	13	13	9	0	24	---	I	15	143	U	
	0 Output disabled											
	1 ON/OFF cold water valve (norm. open)											
	2 ON/OFF hot water valve (norm. open)											
	3 Chiller activation signal, cold water request (norm. open). Contact closed with cold/hot water valve or cold water valve only active (open with valve deactivated)											
	4 Boiler, heat pump activation signal, hot water request (normally open). Contact closed with cold/hot water valve or hot water valve only active (open with valve deactivated)											
	5 ON/OFF hot/cold water valve (normally open). Activated with cooling/heating request from controller. Off when are both deactivated											
	6 ON/OFF heater(normally open) (set parameters P46 & P13)											
	7 Alarm (normally open)											
	8 DO NOT SELECT											
	9 3-point valve + (clockwise) for cold water (hot/cold water if dip4=OFF)*											
	10 3-point valve - (anticlockwise) for cold water (hot/cold water if dip4=OFF)*											
	11 3-point valve + (clockwise) for hot water (deactivated if dip4=OFF) *											
	12 3-point valve - (anticlockwise) for hot water (deactivated if dip4=OFF) *											
	13 Valve with 0 to 10 Vdc input for cold water (hot/cold water if dip4=OFF) *											
	14 Valve with 0 to 10 Vdc input for hot water (deactivated if dip4 =OFF) *											
	15 DO NOT SELECT											
	16 DO NOT SELECT											
	17 0 to 10 Vdc output for modulating heater control (by external module). Set parameters P111, P117.*											
	18 Output (triac or relay) for man. of ON/OFF heaters (with hysteresis) on P+I. Set parameters P111, P112.*											
	19 Open 3-point outside damper*											
	20 Close 3-point outside damper*											
	21 0 to 10 Vdc outside damper											
	22 DO NOT SELECT											
	23 ON/OFF outside damper											
	24 ON/OFF recovery bypass damper											
	(* The P+I parameters need to be set											
40	Configuration of output NO5 (see P39)	14	21	10	0	24	---	I	16	144	U	
41	Configuration of output NO6 (see P39)	23	18	19	0	24	---	I	17	145	U	
42	Configuration of output NO7 (see P39)	0	24	20	0	24	---	I	18	146	U	
43	Configuration of digital input 3	10	10	10	0	14	---	I	19	147	U	
	0 input disabled											
	1 economy (norm. open) varies the set point (cooling= increase, heating= decrease)											
	2 window alarm (norm. open) stops fan and closes the valve											
	3 DO NOT SELECT											
	4 DO NOT SELECT											
	5 local stop (generic alarm norm. open) stops fan and closes the valve											
	6 economy (norm.closed)											
	7 window alarm (norm. closed)											
	8 DO NOT SELECT											
	9 DO NOT SELECT											
	10 local stop (generic alarm normally closed). Stops the fan and closes the valve											
	11 enable antifreeze by time (normally open)											
	12 enable antifreeze by time (normally closed)											
	13 dirty filter alarm from differential pressure switch (normally open)											
	14 dirty filter alarm from differential pressure switch (normally closed)											
44	Configuration of digital input 4 (see P43)	12	12	12	0	14	---	I	20	148	U	
45	Configuration of digital input 5 (see P43)	14	14	14	0	14	---	I	21	149	U	
46	Heater band hysteresis (see P39=6)	30	30	30	0	255	°C/10	A	26	26	U	
47	Max. coil temp. to deactivate heater (see P39=6)	40	40	40	0	255	°C	A	27	27	U	

P	Parameter	Def.1	Def.2	Def.3	Min	Max	UOM	SV type	SV #	Modbus®	access	notes
48	Extra flush time with heater	20	20	20	0	255	s	l	22	150	U	
49	Fan on time in dehumidification	3	3	3	0	255	min	l	23	151	U	
50	Fan off time in dehumidification	15	15	15	0	255	min	l	24	152	U	
51	Hot/cold valve ON time during cycles	0	0	0	0	255	min	l	25	153	U	
52	Max hot/cold valve OFF time during cycles	0	0	0	0	255	min	l	26	154	U	
53	Min hot/cold valve OFF time during cycles	0	0	0	0	255	min	l	27	155	U	
54	Serial communication mode (0=Carel; 1=Modbus)	0	0	0	0	1	---	l	28	156	F	
55	Enable cool & heat symbols in AUTOMATIC	0	0	0	0	1	---	l	29	157	U	
	0   symbols off											
	1   symbols on when called											
56	Function of digital input 2	1	1	1	0	1	---	l	30	158	U	
	0   N.C.=Heating, N.O.=Cooling											
	1   N.C.=Cooling, N.O.=Heating											
	Note: DIP SWITCH 2 must be ON											
57	Mains frequency (0 = 50Hz; 1 = 60Hz)	0	0	0	0	1	---	l	31	159	U	
58	Probe B1 offset in cooling	0	0	0	-99	127	°C/10	A	28	28	U	
59	Probe B1 offset in heating	0	0	0	-99	127	°C/10	A	29	29	U	
60	Probe B1 offset in AUTOMATIC	0	0	0	-99	127	°C/10	A	30	30	U	
61	Probe BT offset from terminal	-30	-30	-30	-99	127	°C/10	A	31	31	U	
62	Probe B2 offset in cooling	0	0	0	-99	127	°C/10	A	32	32	U	
63	Probe B2 offset in heating	0	0	0	-99	127	°C/10	A	33	33	U	
64	Probe B3 offset in cooling	0	0	0	-99	127	°C/10	A	34	34	U	
65	Probe B3 offset in heating	0	0	0	-99	127	°C/10	A	35	35	U	
69	Supervisor network address (use with RS485 serial board only)	1	1	1	0	207	---	l	35	163	F	
91	Load defaults (the device must be OFF)	0	0	0	0	255	---	l	57	185	F	
	44   AHU 100% outside air - 0-10 V valves											
	45   AHU with recirculation - 0-10 V valves											
	46   AHU with recirculation - 3-point valves											
92	Manufacturer password Note: enter manufacturer password to enable type F parameters (=Factory)	0	0	0	0	255	---	l	58	186	F	
95	SET TO 1: DO NOT MODIFY	1	1	1	0	1	---	l	61	189	U	
97	3-point valve actuator travel time	120	120	120	1	255	s	l	63	191	U	
99	Minimum P+I movement Minimum variation in P+I output to move valve (for 0 to 10 V and 3 point valves) and increase heater output. Expressed as a % of the total P+I output.	5	5	5	0	100	%	l	65	193	U	
100	Maximum valve stationary time (to unlock)	4	4	4	0	255	hrs	l	66	194	U	
	0   antistick function disabled											
101	Forced movement for antistick. Considered as a % of the maximum travel set	20	20	20	0	100	%	l	67	195	U	
102	Inactivity hysteresis If output <P102, output =0 If output >100%-P102, output =100%	0	0	0	0	100	%	l	68	196	U	
103	3-point damper actuator travel time	150	150	150	0	255	s	l	69	197	U	
104	Freecooling activation delta	0	20	20	0	255	°C/10	A	36	36	U	
105	Freeheating activation delta	0	20	20	0	255	°C/10	A	37	37	U	
106	Minimum cooling valve/heating valve-heater outlet temperature (127 = function disabled)	127	18	18	-28	127	°C	A	38	38	U	
107	Bumpless transfer mode	1	1	1	0	3	---	l	104	232	U	
	0   no management of the transients for a change in actuator, variation in P+I parameters and variation in the set point											
	1   gradual activation when changing actuator											
	2   gradual activation when changing actuator and gradual response to variations in P+I parameters											
	3   gradual act. when changing actuator, gradual response to var. in P+I parameters & set point											
108	Integration time (0=disabled)	0	6	6	0	255	s*10	l	99	227	U	
109	Dead band	2	2	2	0	255	°C/10	A	43	43	U	
110	Heating valve activation delta	0	0	0	0	255	°C/10	A	44	44	U	
111	Heater activation delta	30	30	30	0	255	°C/10	A	45	45	U	
112	Heater hysteresis (p39=18)	5	5	5	0	255	°C/10	A	46	46	U	
113	Cooling valve activation delta	0	0	0	0	255	°C/10	A	47	47	U	
114	Damper proportional band	0	30	30	0	255	°C/10	A	39	39	U	
115	Cooling valve proportional band	30	30	30	0	255	°C/10	A	40	40	U	
116	Heating valve proportional band	30	30	30	0	255	°C/10	A	41	41	U	
117	Heater proportional band	0	0	0	0	255	°C/10	A	42	42	U	


P	Parameter	Def.1	Def.2	Def.3	Min	Max	UOM	SV type	SV #	Modbus®	access	notes	
118	Fan mode	2	2	2	0	2	---	I	100	228	U		
	0												3 speed
	1												minimum speed
	2	continuous single-speed (normally used for AHUs)											
119	Minimum outside damper position	0	20	20	0	100	%	I	101	229	U		
120	Enable antifreeze	2	2	2	0	2	---	I	102	230	U		
	0												Disabled
	1												Enable by probe
	2	Enable by digital input											
121	Antifreeze activation threshold	2	2	2	-28	50	°C	A	48	48	U		
122	Antifreeze deactivation threshold	7	7	7	-28	50	°C	A	49	49	U		
123	Antifreeze time	2	2	2	1	255	min	I	103	231	U		
124	Unit model	0	0	1	0	1	---	I	108	236	U		
	0												100% outside air
	1												With recirculation
125	Max. outlet temperature max (127 = function disabled)	127	28	28	-28	127	°C	A	50	50	U		
126	Outlet limit differential	20	20	20	10	255	°C/10	A	51	51	U		
127	Close bypass damper set point	20	20	20	0	255	°C/10	A	52	52	U		

Tab.4.t

Variables only accessible via serial connection

Variable	Def.	Min.	Max.	UOM	SV type	SV #	Modbus®	R/W
Probe B1	0	---	---	°C	A	70	70	R
Probe BT	0	---	---	°C	A	71	71	R
Probe B2	0	---	---	°C	A	72	72	R
Probe B3	0	---	---	°C	A	73	73	R
Control probe	0	---	---	°C	A	74	74	R
Control set point	---	---	---	°C	A	76	76	R
Mode	0	0	6	---	I	70	198	
0   AUTOMATIC	4	Ventilation						
1   AUTOMATIC + heater	5	Heating						
2   Cooling	6	Heating + heater						
3   Dehumidification								
Fan	0	0	3	---	I	71	199	
0   Autofan	2	Medium						
1   Minimum	3	Maximum						
ON/OFF	0	0	1	---	I	73	201	
Control probe enabled (0=BT; 1=B1)	0	0	1	---	I	74	202	R/W do not modify
Alarms	0	---	---	---	I	76	204	R
Lock keypad	0			---	I	78	206	R/W do not modify
General flags 1	---	---	---	---	I	79	207	
1   Heater available	16	Broadcasting active						
2   NOT USED	32	Sleep/Eco						
4   RESERVED	64	Lock function						
8   Remote control	128	RESERVED						
General flags 2					I	80	208	
1   Cooling active	16	RESERVED						
2   Heating active	32	RESERVED						
4   Comfort active	64	RESERVED						
8   Economy	128	NOT USED						
Digital inputs & control signals	---	---	---	---	I	81	209	
1   Input 1 (remote ON/OFF)	16	Input 5 (multifunction)						
2   Input 2 (remote cooling/heating)	32	Heating control signal						
4   Input 3 (multifunction)	64	Cooling control signal						
8   Input 4 (multifunction)	128	NOT USED						
Sleep/Eco	0	0	1	---	I	82	210	
Set point setting	0	8	32	°C	I	83	211	
Comfort control	0	-2	+2	°C	I	84	212	
General flags 3	---	---	---	---	I	85	213	
1   Cooling symbol	16	NOT USED						
2   Heating symbol	32	NOT USED						
4   RESERVED	64	NOT USED						
8   Display set point/probe	128	NOT USED						

Tab. 4.u

 **Note**  
 SV type: type of variable (A=analogue, I=integer, D=digital)  
 SV #: variable address with CAREL protocol on 485 serial board  
 Modbus®: variable address with Modbus® protocol on 485 serial board

## 5. SYSTEM DIAGRAMS

### 5.1 System 1

System 1 is one of the systems that can be configured automatically by setting parameter **P91 = 44** (see the paragraph on "configuration"). Suitable for small air handling units with hot water coil and cold water coil fitted with modulating valve and ON/OFF outside damper.

**Features:**

- AHU with 100% outside air (P124=0);
- Room temp. control with sensor on the "acqua" terminal;

- Proportional hot water valve control (0 to 10 Vdc);
- Proportional cold water valve control (0 to 10 Vdc);
- Single-speed fan control;
- ON/OFF outside damper control;
- Antifreeze protection on air side by digital input;
- Set point compensation function with outside probe, can be activated by setting P22=2 and P23, P24, P25, P26≠0

**Block diagram**

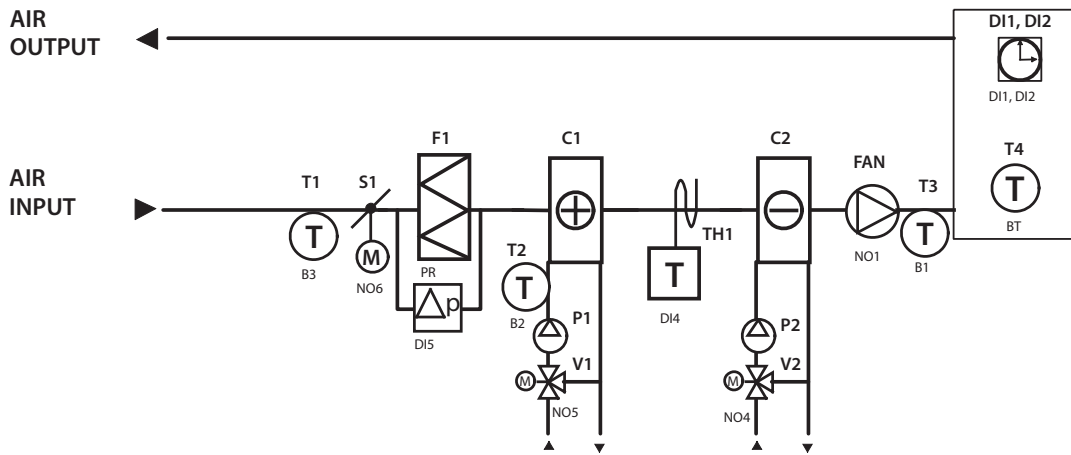


Fig. 5.a

**Key:**

<b>AI</b> analogue inputs	<b>AO</b> analogue outputs	F1	filter
T1 outside probe	V2 cooling coil valve	C1	heating coil
T2 heating coil probe	V1 heating coil valve	C2	cooling coil
T3 outlet probe	<b>DO</b> digital outputs	P1, P2	pumps (conn. by installer)
T4 probe on "acqua" terminal	FAN fan	L	line
<b>DI</b> digital inputs	S1 outside damper	N	neutral
DI1 ON/OFF		FU	fuse
DI2 cooling/heating			
DI3 serious alarm (not indicated)			
TH1 antifreeze thermostat			
PR differential pressure switch (filter alarm)			

**Wiring diagram**

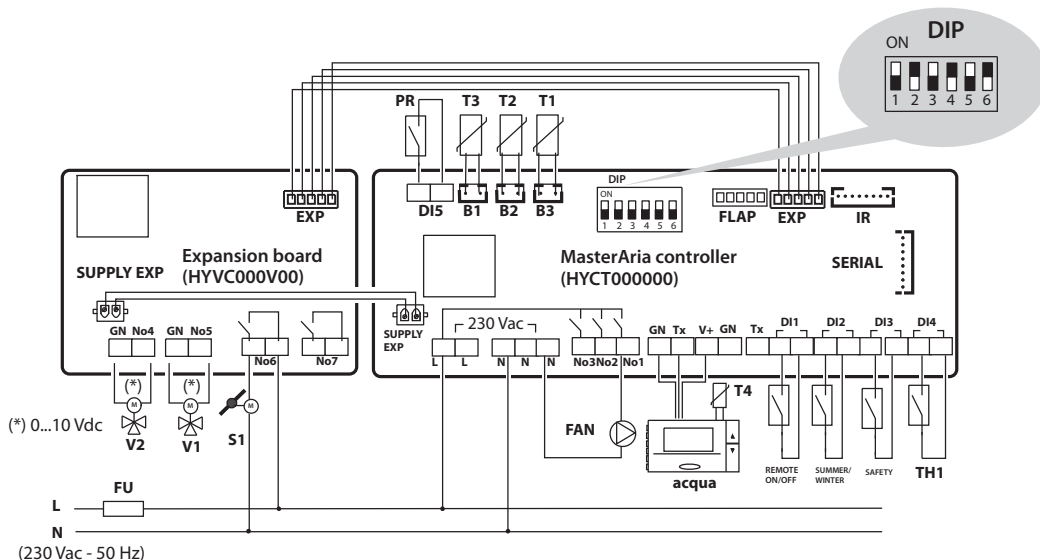


Fig. 5.b

**Note:** The 0 to 10 Vdc outputs (NO4 and NO5) only provide the control signal to the actuators. The power supply (230 Vac or 24 Vac) is the installer's responsibility

**Table of dipswitch settings**

function	n.	function setting	position
heat,cool-enable functions	1	deactivated	OFF
remote cooling/heating (DI2)	2	activated	ON
remote lock active	3	deactivated	OFF
2 coils available	4	activated	ON
electric heater fitted	5	deactivated	OFF
control probe on "acqua" terminal	6	activated	ON

Tab. 5.a

**Functional diagrams**

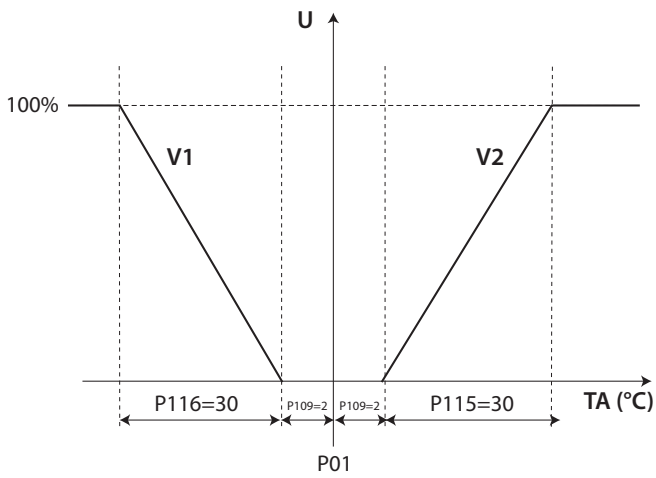


Fig. 5.c

**Important:** drawing not to scale for graphics requirements.

- Key:**
- P115 proportional band for cooling valve (°C/10)
  - P116 proportional band for heating valve (°C/10)
  - P109 dead band (°C/10)
  - P01 set point
  - TA room temperature (control probe)
  - V1 heating valve
  - V2 cooling valve
  - U outputs

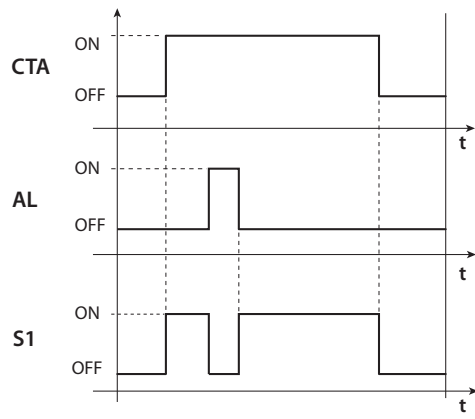


Fig. 5.d

- Key:**
- AHU air handling unit
  - AL alarm
  - S1 outside damper
  - t time

**Description of the functions**

- The hot water and cold water valves are opened according to the activation delta (default =0) and the P+I algorithm proportional bands;
- the ON/OFF outside damper is activated when the air handling unit is started. It closes in the event of antifreeze alarms, activated by digital input DI4;
- dirty filter alarm via differential pressure switch connected to digital input DI5.

### 5.2 System 2

System 2 is one of the systems that can be configured automatically by setting parameter **P91 = 45** (see the paragraph on configuration). Suitable for small air handling units with hot/cold water coil, modulating outside damper, ON/OFF heat recovery bypass damper.

**Features:**

- AHU with heat recovery unit (P124=0);

- room temp. control with sensor on the "acqua" terminal;
- modulating hot/cold water valve control (0 to 10 Vdc);
- single-speed fan control;
- modulating outside damper control (0 to 10 Vdc);
- antifreeze protection on air side by digital input;
- set point compensation function with outside probe, can be activated by setting P22=2 and P23, P24, P25, P26≠0.

**Block diagram**

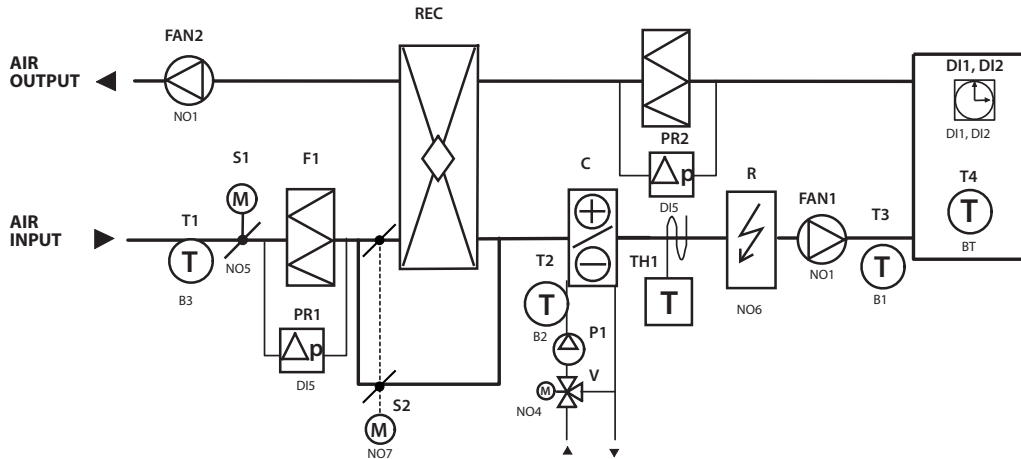


Fig. 5.e

**Key:**

<b>AI</b> analogue inputs	<b>AO</b> analogue outputs	P1	pump (conn. by installer)
T1 outside probe	V heating/cooling coil valve	REC	heat pump
T2 heating/cooling coil probe	S1 outside damper	F1, F2	filter
T3 outlet probe	<b>DO</b> digital outputs	C	hot/cold water coil
T4 probe on "acqua" terminal	FAN 1, 2 fans	L	line
<b>DI</b> digital inputs	S1 outside damper	N	neutral
DI1 ON/OFF	S2 heat recovery bypass damper	FU	fuse
DI2 cooling/heating	R electric heater		
DI3 serious alarm (not indicated)			
TH1 antifreeze thermostat			
PR1, PR2 differential pressure switch (filter alarm)			

**Wiring diagram**

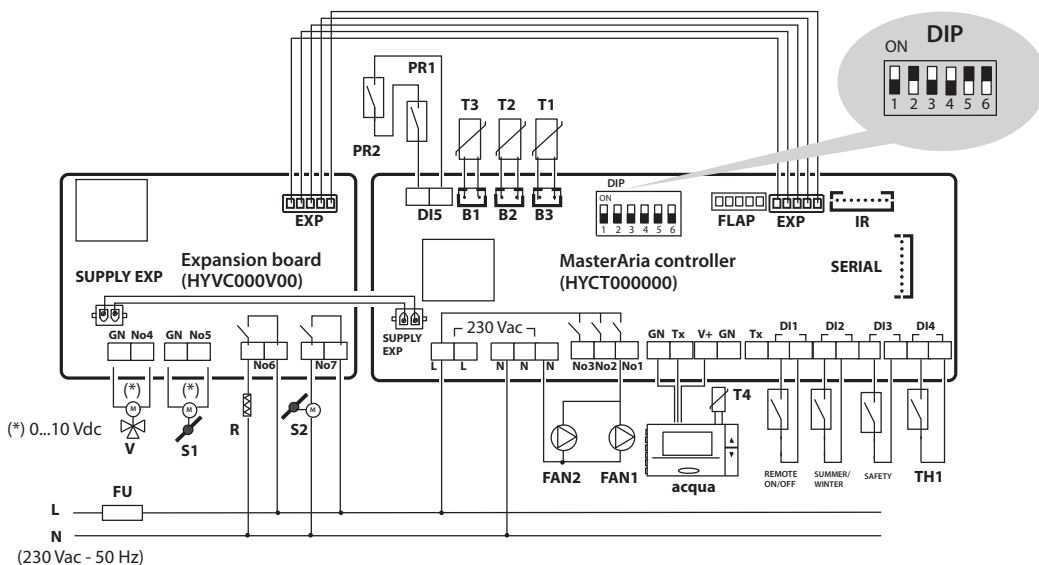


Fig. 5.f

**Note:** The 0 to 10 Vdc outputs ( NO4 and NO5) only provide the control signal to the actuators. The power supply (230 Vac or 24 Vac) is the installer's responsibility.

Table of dipswitch settings

function	n.	function setting	position
heat, cool-enable functions	1	deactivated	OFF
remote cooling/heating (DI2)	2	activated	ON
remote lock active	3	deactivated	OFF
2 coils available	4	deactivated	OFF
electric heater fitted	5	activated	ON
control probe on "acqua" terminal	6	activated	ON

Tab. 5.b

Functional diagrams

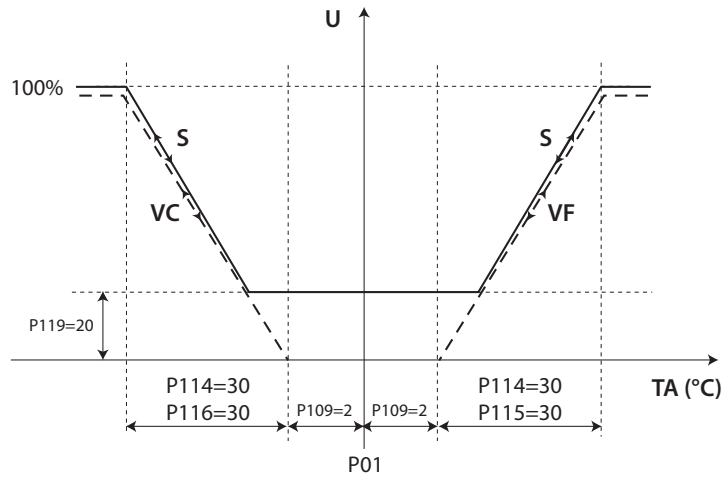


Fig. 5.g

**Important:** drawing not to scale for graphics requirements.

- Key:**
- |      |   |    |                                  |
|------|---|----|----------------------------------|
| P114 | proportional band for damper (°C/10)        | S  | outside damper                   |
| P115 | proportional band for cooling valve (°C/10) | TA | room temperature (control probe) |
| P116 | proportional band for heating valve (°C/10) | VC | heating valve                    |
| P109 | dead band (°C/10)                           | VF | cooling valve                    |
| P01  | set point                                   | U  | outputs                          |

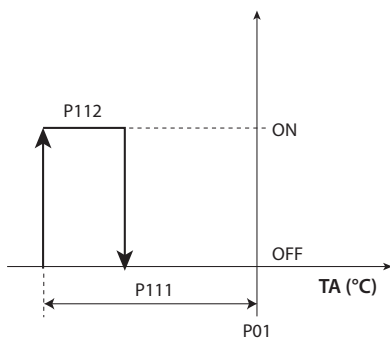


Fig. 5.h

- Key:**
- |      |                                  |
|------|----------------------------------|
| P111 | heater activation delta          |
| P112 | heater hysteresis                |
| R    | heater                           |
| TA   | room temperature (control probe) |

Description of the functions

- The hot/cold water valve is opened according to the activation delta (default =0) and the P+I algorithm proportional bands;
- the outside damper is activated when the air handling unit is started. It closes in the event of antifreeze alarms, activated by digital input DI4;
- the heat recovery unit damper is opened in cooling or heating if the conditions are favourable (see the paragraph on the heat recovery unit);
- dirty filter alarm via differential pressure switch connected to digital input DI5.

### 5.3 System 3

System 3 is one of the systems that can be configured automatically by setting parameter **P91 = 46** (see the paragraph on configuration). Suitable for small air handling units with hot/cold water coil and outside damper with three-point actuators.

**Features:**

- AHU with recirculation (P124=1);
- room temperature control with sensor on the "acqua" terminal;
- three-point hot/cold water valve control;

- single-speed fan control;
- three-point outside damper control;
- antifreeze protection on air side by digital input and on water side by probe;
- set point compensation function with outside probe.

**Block diagram**

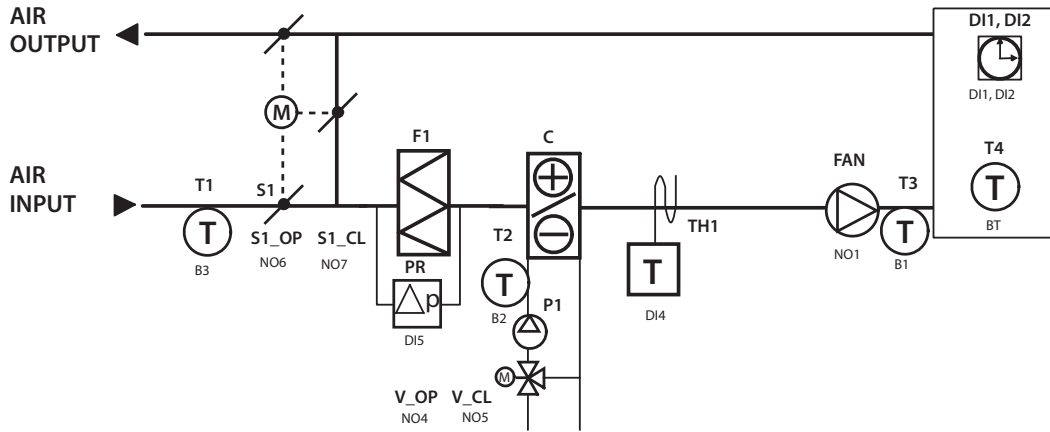


Fig. 5.i

**Key:**

<b>AI</b> analogue inputs	<b>AO</b> analogue outputs	F1 filter
T1 outside probe	<b>DO</b> digital outputs	C heating/cooling coil
T2 probe heating/cooling coil	S1_OP open damper	P1 pump (conn. by installer)
T3 outlet probe	S1_CL close damper	L line
T4 probe on "acqua" terminal	V_OP open valve	N neutral
<b>DI</b> digital inputs	V_CL close valve	FU fuse
DI1 ON/OFF	FAN fan	
DI2 cooling/heating		
DI3 serious alarm (not indicated)		
TH1 antifreeze thermostat		
PR differential pressure switch (filter alarm)		

**Wiring diagram**

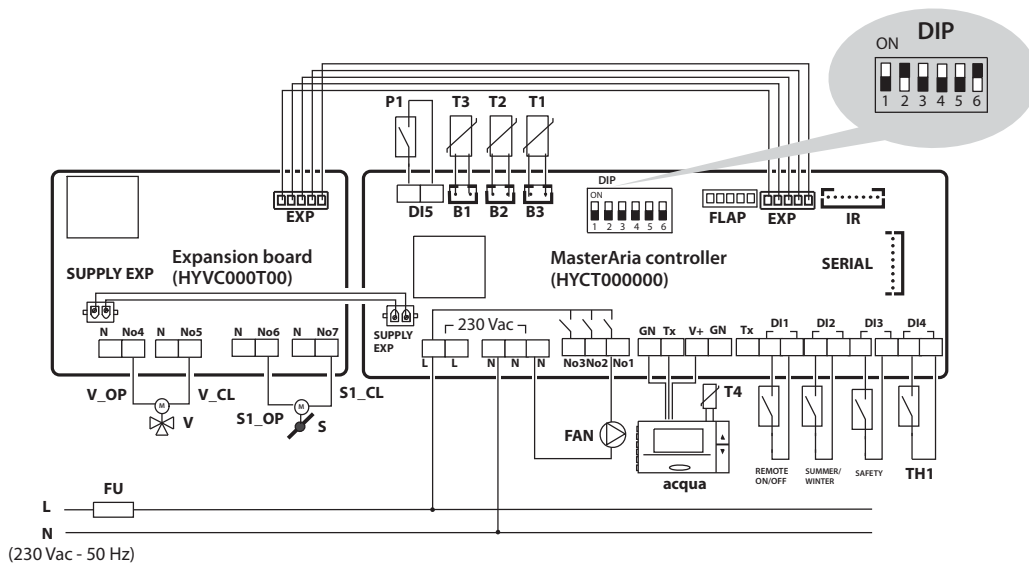


Fig. 5.j

**Note:** The 0 to 10 Vdc outputs (NO4 and NO5) only provide the control signal to the actuators. The power supply (230 Vac or 24 Vac) is the installer's responsibility.

Table of dipswitch settings

function	n.	function setting	position
heat,cool-enable functions	1	deactivated	OFF
remote cooling/heating (DI2)	2	activated	ON
remote lock active	3	deactivated	OFF
2 coils available	4	deactivated	OFF
electric heater fitted	5	deactivated	OFF
control probe on "acqua" terminal	6	activated	ON

Tab. 5.c

Functional diagrams

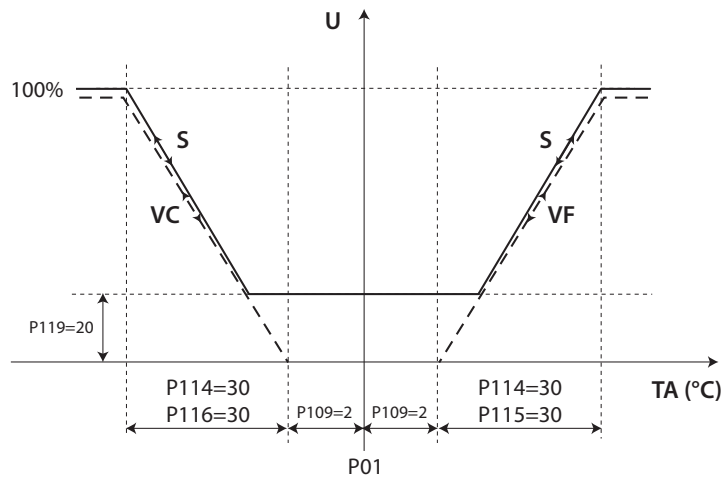


Fig. 5.k

**Important:** drawing not to scale for graphics requirements.

- Key:**
- P114 proportional band for damper (°C/10)
  - P115 proportional band for cooling valve (°C/10)
  - P116 proportional band for heating valve (°C/10)
  - P109 dead band (°C/10)
  - P01 set point
  - S outside damper
  - TA room temperature (control probe)
  - VC heating valve
  - VF cooling valve
  - U outputs

Description of the functions

- The hot/cold water valve is opened according to the activation delta (default =0) and the P+I algorithm proportional bands;
- the outside damper is activated when the air handling unit starts. It closes in the event of antifreeze alarms, activated by digital input DI4;
- the recirculation damper is managed with the same output as the outside damper, as operation is complementary (the connection is the installer's responsibility);
- dirty filter alarm via differential pressure switch connected to digital input DI5.

General warnings

- The required applications may differ from systems 1, 2, 3. Make the desired settings by modifying the parameters shown in columns "Def1, Def2 and Def.3" respectively of the table of parameters;
- the digital signals cannot be checked. If the digital input has an important protection function, such as the antifreeze function, it is recommended to configure the input so that an alarm is generated when there is no signal (not wired). Set as normally closed;
- if control is unstable, increase the proportional band and the integration time.

## 6. NON-HYDRONIC SUPERVISORY SYSTEMS

The RS485 serial board (code HYSC00F0P0) can be used to communicate with custom supervisory systems, such as PlantVisor. The same accessory can be used to install MasterAria in systems based on Modbus® (enable Modbus® with parameter P54=1), see paragraph 3.8.


## 7. TECHNICAL SPECIFICATIONS AND PURCHASE CODES

### 7.1 MasterAria electrical panel

#### Assembly and installation instructions

Power supply:	Three-phase model	Voltage: 400 V~. 50/60 Hz; Power: 4 kW
	Single-phase model	Voltage: 230 V~. 50/60 Hz; Power: 1.5 kW
Switching power	10 kA	
Insulation guaranteed by the power supply: (for both models)	insulation from very low voltage parts: reinforced, 6 mm in air, 8 mm on surface, 3750 V insulation.insulation from relay outputs: basic, 3 mm in air, 4 mm on surface, 1250 V insulation	
Connections:		
Panel power supply	0.75 to 10 mm <sup>2</sup>	
Contacteur connection	0.75 to 2.5 mm <sup>2</sup>	
Terminal connection	0.2 to 4 mm <sup>2</sup>	
Motor protector connection	1 to 25 mm <sup>2</sup>	
Probes	up to 10 m maximum	
Digital inputs	30 m (AWG 14-22)	
LCD panel - tLAN communication	30 m (AWG 14-22)	
Serial board communication	see the corresponding paragraph	
Power supply	5 m (AWG 14-22)	
Power outputs (relays)	30 m (AWG 14-22)	
Plastic case:	dimensions 200 x 240 x 87 mm;	
Installation:	wall-mounting (with plastic case): by fastening screw (spacing 162.5 x 218.5); panel assembly (with plastic faceplate): by fastening screw (spacing 159.5 x197.5); open board: main board by fastening screw and front board by fastening screw. The controller must be protected against accidental contact to avoid electric shock.	
Operating conditions:	with plastic case = -10T50 °C; <90% rH non-condensing	
Storage conditions:	-20T80 °C, humidity 80% rH non-condensing	
Front panel index of protection:	with plastic case: IP54	
Environmental pollution:	2 (normal)	
PTI of the insulating materials:	printed circuits 250, plastic and insulating materials 175.	
Period of stress across the insulating parts:	long	
Category of resistance to fire:	category D & category B (UL 94-V0)	
Class of protection against voltage surges:	category 2	
Type of action and disconnection:	1B relay contacts (microswitching)	
Classification according to protection against electric shock:	class 2 when suitably integrated	
Device designed to be hand-held or integrated into equipment designed to be hand-held:	no	
Cleaning the front panel of the instrument:	only use neutral detergents and water	

Tab. 7.a

 **Note:** the correct sizing of the power and connection cables between the instrument and the loads is the installer's responsibility. In max. load and max. operating temp. conditions, the cables used must be suitable for operation up to 105 °C.

#### Protection against electric shock and maintenance warnings

The system made up of the control board (HYCT0\*) and the other optional cards (HYVC000R0\*, HYVC00T0\*, HYVCT00M0\*, pCO serial boards etc.)

represents a control device to be integrated into class 1 or 2 appliances. The class relating to protection against electric shock depends on the way the control device is integrated into the unit made by the manufacturer. Disconnect the power supply before working on the board during assembly, maintenance and replacement operations.

The protection against short-circuits must be guaranteed by the manufacturer of the appliance that the control device is integrated into or by the installer.

## 7.2 Main control board

### Warnings valid for all boards:

- All installation and maintenance operations must be carried out with the unit off;
- Use shielded cables for the serial connections: 2 wires + shield for

networks with optional serial boards. Do not use star connections (use chain connections). Connect the shield to the GN terminal;

- Avoid short-circuits between GN and V+ (power supply to "acqua" terminal);
- Adopt precautions against electrostatic discharges when handling the board (e.g.: antistatic bracelet);
- Connect the GN terminal to earth.

### Inputs-outputs

Terminal	Meaning												
L	Line												
N	Neutral												
No1	Minimum fan speed (normally open). Voltage output (L)												
No2	Medium fan speed (normally open). Voltage output (L)												
No3	Maximum fan speed (normally open). Voltage output (L)												
GN, Tx, V+	LCD panel connection												
GN, Tx	NOT USED												
DI1, DI2, DI3, DI4, DI5	Digital inputs, voltage-free contacts:												
	<table border="1"> <tr> <td>1</td> <td>remote ON/OFF</td> <td>4</td> <td>configurable</td> </tr> <tr> <td>2</td> <td>remote cooling/heating</td> <td>5</td> <td>configurable</td> </tr> <tr> <td>3</td> <td>configurable</td> <td></td> <td></td> </tr> </table>	1	remote ON/OFF	4	configurable	2	remote cooling/heating	5	configurable	3	configurable		
1	remote ON/OFF	4	configurable										
2	remote cooling/heating	5	configurable										
3	configurable												
B1	Configurable probe												
B2	Configurable probe												
B3	Configurable probe												
DIP	Configuration dipswitch:												
	<table border="1"> <tr> <td>1 ON</td> <td>Enable heat/cool enable (probe B2)</td> <td>4 ON</td> <td>Fan coil 4 pipe (OFF=2 pipe)</td> </tr> <tr> <td>2 ON</td> <td>Enable remote cooling/heating</td> <td>5 ON</td> <td>Heater fitted</td> </tr> <tr> <td>3 ON</td> <td>Limited functions</td> <td>6 ON</td> <td>Control on terminal probe</td> </tr> </table>	1 ON	Enable heat/cool enable (probe B2)	4 ON	Fan coil 4 pipe (OFF=2 pipe)	2 ON	Enable remote cooling/heating	5 ON	Heater fitted	3 ON	Limited functions	6 ON	Control on terminal probe
1 ON	Enable heat/cool enable (probe B2)	4 ON	Fan coil 4 pipe (OFF=2 pipe)										
2 ON	Enable remote cooling/heating	5 ON	Heater fitted										
3 ON	Limited functions	6 ON	Control on terminal probe										
EXP	Connector for the expansion board (5-wire cable)												
FLAP	NOT USED												
SUPPLY EXP	Expansion board power supply connector (2-wire cable)												
IR	NOT USED												
JS3	Connector for inserting optional power supply for compatibility with pCO serial boards (future use)												
SERIAL	Connector for inserting optional serial boards												

Tab. 7.b

### Technical specifications

Power supply	230 Vac, range -15 to +10%; 50/60 Hz; Maximum power input (excluding relay loads): 4VA
Screw terminals (ext. unit power supply)	max voltage: 230 V; Cable cross-section: 14-22 AWG The current input from the mains (sum of the current inputs of the loads plus the external module) must not exceed 6 A.
Relay outputs No1, No2, No3	maximum current: VDE0631: 6 (2) A, 250 Vac minimum interval between switching cycles (each relay): 12 s (the manufacturer of the unit that the device is integrated into must guarantee the correct configuration to respond to this specification) type of relay action-microswitching: 1C insulation between low (relay outputs) and very low voltage parts: Reinforced
Digital inputs	electrical standard: voltage-free contact closing current referred to earth: 5 mA maximum closing resistance: 50 Ω
Analogue inputs	B1, B2, B3: CAREL NTC temperature sensors (10 kΩ at 25 °C).
Index of protection	IP00
Storage conditions	-20T80 °C, humidity 80% rH non-condensing
Operating conditions	0T60 °C, humidity <90% rH non-condensing
Pollution	normal
Category of resistance to heat and fire	D
PTI of the insulating materials	for all materials PTI≥250
Software class and structure	A
Period of stress across the insulating parts	long

Tab. 7.c

### Maximum cable lengths:

probes:	10 m
digital inputs:	30 m (AWG 14-22)
LCD panel - tLAN communication	30 m (AWG 14-22)
serial board communication	see the corresponding instruction sheet
power supply	5 m (AWG 14-22)
power outputs (relays)	30 m (AWG 14-22)

Tab. 7.d

### Functional characteristics

Resolution of analogue inputs:	temperature probes: interval -40 to 80 °C, 0.1 °C
Temperature measurement error:	interval -20 to 25 °C, ±0.5 °C (excluding probe) interval 25 to 30 °C, ±1 °C (excluding probe) interval 30 to 90 °C, ±1.5 °C (excl. probe)

Tab. 7.e

### Connections (See wiring diagram)

## 7.3 Expansion board with 2 x 0-10 Vdc outputs/2 relays

### Inputs-outputs

Terminal	Meaning
SUPPLY EXP	power supply connector (connect by 2-wire cable to the main board)
EXP	input signal connector (use 5-wire cable)
GN	input signal connector (use 5-wire cable)
No4	multifunction 0 to 10 Vdc output: see the outputs section (configurable by parameter P39)
No5	multifunction 0 to 10 Vdc output: see the outputs section (configurable by parameter P40)
No6	multifunction relay output: see the outputs section (configurable by parameter P41). Voltage-free contact
No7	multifunction relay output: see the outputs section (configurable by parameter P42). Voltage-free contact

Tab. 7.f

Maximum cable lengths 0 to 10 Vdc outputs No4, No5: 5 m.  
 Maximum cable lengths for relay outputs (voltage-free contacts) No6, No7: 5 m.



#### Warnings:

- avoid short-circuits between terminals No4, No5 and the GN terminals.
- keep the power cable (relay outputs separate) from the cables running to the 0 to 10 Vdc outputs.

### Technical specifications

Power supply	230 Vac, range -15 to +10%; 50/60 Hz; maximum power input: 1.5 VA
Screw terminals	max voltage: 250 V cable size: 14-22 AWG max current: see outputs No4-7
0 to 10 Vdc outputs No4, No5	minimum impedance of the 0 to 10 Vdc actuator input stage (damper, valve, ...): 10 KOhm
Relay outputs No6, No7 (voltage-free contacts)	maximum current at 250 Vac: - EN60730: resistive 2 A, inductive: 2 A cos(j)=0.4 60000 cycles type of relay action-microswitching: 1C
Insulation	insulation between the relay outputs No6 and No7: reinforced insulation between the relay outputs No6, No7 and very low voltage parts: reinforced insulation between 0 to 10 Vdc outputs and relay outputs No6, No7: reinforced
Index of protection	IP00
Storage conditions	-20T80 °C, humidity 80% rH non-condensing
Operating conditions	0T60 °C, humidity <90% rH non-condensing
Pollution	normal
Category of resistance to heat and fire	D
PTI of the insulating materials	for all materials PTI≥250
Period of electrical stress across the insulating parts	long

Tab. 7.g

## 7.4 Expansion board with 4 relays (accessory)

### Inputs-outputs

Terminal	Meaning
SUPPLY EXP	power supply connector (connect by 2-wire cable to the main board)
EXP	MasterAria input signal connector(use 5-wire cable)
N	neutral
No4	multifunction voltage output (L)
No5	multifunction voltage output (L)
No6	voltage free contact
No7	voltage free contact

Tab. 7.h

Maximum cable lengths for voltage outputs No4 & No5: 5 m

Maximum cable lengths for outputs No6 & No7: 30 m (as voltage-free contact), 5 m (as control signal to power any load).

### Technical specifications

Power supply	230 Vac, range -15 to +10%; 50/60 Hz; maximum power input: 1.5 VA
Screw terminals	max voltage: 230 V cable cross-section: 14-22 AWG the current input from the mains (sum of the current inputs of the loads, the main board, the expansion and the external module) must not exceed 6 A.
0 to 10 Vdc outputs No4, No5	minimum impedance of the 0 to 10 Vdc actuator input stage (damper, valve,...): 10 KOhm
Relay outputs No4, No5, No6, No7	maximum current at 250 Vac: - EN60730: resistive 2 A, inductive: 2 A cos(j)=0.4 60000 cycles type of relay action-microswitching: 1C For the voltage outputs No4 and No5 respect the maximum limits described in the field "screw terminals". minimum interval between switching cycles (each relay): 12 s (the manufacturer of the unit that the device is integrated into must guarantee the correct configuration to respond to this specification) type of relay action-microswitching: 1C
Insulation	insulation between low (relay outputs) and very low voltage parts: reinforced insulation between outputs with voltage signal No4, No5 and outputs No6, No7: reinforced insulation between outputs No6 and No7: reinforced. If using serial boards, output No7 can be limited to very low voltage only. See the user manual.
Index of protection	IP00
Storage conditions	-20T80 °C, humidity 80% rH non-condensing
Operating conditions	0T60 °C, humidity <90% rH non-condensing
Pollution	normal
Category of resistance to heat and fire	D
PTI of the insulating materials	for all materials PTI≥250
Period of electrical stress across the insulating parts	long

Tab. 7.i

## 7.5 Expansion board with 4 triacs (accessory)

### Inputs-outputs

Terminal	Meaning
SUPPLY EXP	power supply connector (connect by 2-wire cable to the main board)
EXP	input signal connector (use 5-wire cable)
N	neutral
No4	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P39)
No5	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P40)
No6	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P41)
No7	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P42)

Tab. 7.j

Maximum cable lengths for voltage outputs No4, No5, No6, No7: 5m.

### Technical specifications

Power supply	230 Vac, range -15 to +10%; 50/60 Hz; maximum power input (excluding triac loads): 1.5 VA
Screw terminals	max voltage: 250 V cable size: 14-22 AWG max current: see outputs No4-7
Voltage outputs No4, No5, No6, No7	maximum current at 250 Vac (for each voltage output): 0.3 A. type of triac action: electronic disconnection
Insulation	insulation between low (triac outputs) and very low voltage parts: reinforced insulation between triac voltage outputs No4, No5, No6, No7: functional
Index of protection	IP00
Storage conditions	-20T80 °C, humidity 80% rH non-condensing
Operating conditions	0T60 °C, humidity <90% rH non-condensing
Pollution	normal
Category of resistance to heat and fire	D
PTI of the insulating materials	for all materials PTI ≥ 250
Period of electrical stress across the insulating parts	long

Tab. 7.k

## 7.6 Expansion board with 2 triacs/2 relays (accessory)

### Inputs-outputs

Terminal	Meaning
SUPPLY EXP	power supply connector (connect by 2-wire cable to the main board)
EXP	input signal connector (use 5-wire cable)
N	neutral
No4	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P39)
No5	multifunction TRIAC voltage output: see the outputs section (configurable by parameter P40)
No6	multifunction relay output, 2 A resistive: see the outputs section (configurable by parameter P41). Voltage-free contact
No7	multifunction relay output, 10 A resistive: see the outputs section (configurable by parameter P42). Voltage-free contact

Tab. 7.l

Maximum cable lengths for voltage outputs No4, No5: 5m

Maximum cable lengths for relay outputs No6, No7: 5m

### Technical specifications

Power supply	230 Vac, range -15 to +10%; 50/60 Hz; maximum power input (excluding triac loads): 1.5 VA
Screw terminals	max voltage: 250 V cable size: 14-22 AWG max current: see outputs No4-7
Voltage outputs No4, No5	maximum current at 250 Vac (for each voltage output): 0.3 A. type of triac action: electronic disconnection
Relay output No6	maximum current at 250 Vac: EN60730: Resistive 2 A, Inductive: 2 A $\cos(\varphi)=0.4$ 60000 cycles
Relay output No7	maximum current at 250 Vac: EN60730: Resistive 10 A, 100000 cycles type of relay action-microswitching: 1 C
Insulation	insulation between low (triac outputs) and very low voltage parts: reinforced insulation between triac voltage outputs No4, No5: functional insulation between triac voltage outputs No4, No5 and relay outputs No6, No7: reinforced insulation between outputs the two relay outputs No6, No7: reinforced
Index of protection	IP00
Storage conditions	-20T80 °C, humidity 80% rH non-condensing
Operating conditions	0T60 °C, humidity <90% rH non-condensing
Pollution	normal
Category of resistance to heat and fire	D
PTI of the insulating materials	for all materials PTI $\geq$ 250
Period of electrical stress across the insulating parts	long

Tab. 7.m

## 7.7 "Acqua" remote terminal (accessory)

### Inputs/outputs

Terminal	Meaning
GN	use for connection to GN terminal and with the cable shield
Tx	use for connection to Tx terminal
V+	use for connection to V+ terminal

Tab. 7.n

Maximum shielded connection cable length: 30 m

### Technical specifications

Power supply	8 to 25 Vdc	8 to 25 Vdc (supplied by the main board)
Insulation		insulation between low (relay outputs) and very low voltage parts: reinforced (guaranteed by main board and by shielded connection cable)
Index of protection		IP30
Storage conditions		-20T80 °C, humidity 80% rH non-condensing
Operating conditions		0T60 °C, humidity <90% rH non-condensing
Pollution		normal
Category of resistance to heat and fire		D
PTI of the insulating materials		for all materials PTI≥250
Period of electrical stress across the insulating parts		long

Tab. 7.o

## 7.8 RS485 serial board (accessory)

### Inputs/outputs

Terminal	Meaning
1-GN	RS485 connection
2-RX+/TX+	
3- RX-/TX-	
SERIAL	8-pin connector for power supply and communication signal from main board to RS485 network
7-pin connector	reserved for future use

Tab. 7.p

### Warnings:

- Use shielded cables for the serial connections: 2 wires + shield, do not use star connections (use chain connections);
- Connect the shield to the GND terminal and insert the two 120 ohm terminal resistors at the ends of the RS485 network (Fig. 7.a);
- The serial board is not optically isolated, each device must be supplied by a dedicated transformer and must not be earthed (the transformer is already included on the MasterAria main board).

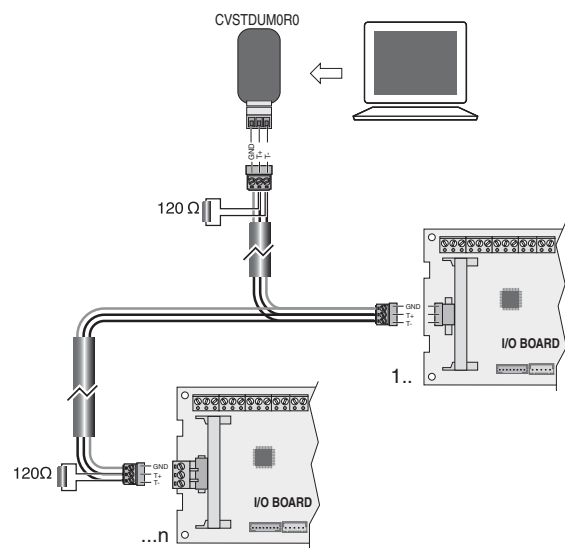


Fig. 7.a

### Technical specifications

Power supply	8 to 38 Vdc	8 to 38 Vdc; maximum power input: 250 mW
Cable size		use twisted pair plus shield, AWG 20/22, min. cross-section 0.2 - max 2.5 mm <sup>2</sup>
Insulation		board not optically isolated
Storage conditions		-20T80 °C, humidity 80% rH non-condensing
Operating conditions		0T60 °C, humidity <90% rH non-condensing
Pollution		normal
Index of protection		IP00
Category of resistance to heat and fire		D
PTI of the insulating materials		for all materials PTI≥250
Period of electrical stress across the insulating parts		long
Dimensioni		60x31x10, (60x31: board; 10: component width)

Tab. 7.q

## 7.9 Codes

code	description
CTEM700000	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 0.1 to 0.16 A
CTEM700001	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 0.16 to 0.25 A
CTEM700002	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 0.25 to 0.40 A
CTEM700003	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 0.40 to 0.63 A
CTEM700004	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 0.63 to 1 A
CTEM700005	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 1 to 1.6 A
CTEM700006	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 1.6 to 2.5 A
CTEM700007	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 2.5 to 4 A
CTEM700008	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 4 to 6.3 A
CTEM700009	single-phase electrical panel for 1.5 kW fan motor with adjustable overload protector 6.3 to 10 A
CTEDB00000	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 0.1 to 0.16 A
CTEDB00001	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 0.16 to 0.25 A
CTEDB00002	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 0.25 to 0.40 A
CTEDB00003	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 0.40 to 0.63 A
CTEDB00004	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 0.63 to 1 A
CTEDB00005	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 1 to 1.6 A
CTEDB00006	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 1.6 to 2.5 A
CTEDB00007	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 2.5 to 4 A
CTEDB00008	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 4 to 6.3 A
CTEDB00009	three-phase electrical panel for 4 kW fan motor with adjustable overload protector 6.3 to 10 A
HYCT000000	main control board
HYPAA001000	"acqua" remote terminal (single pack)
HYVC000R00	expansion board with 4 relay outputs
HYVC000T00	expansion board with 4 triac outputs
HYVC000V00	expansion board with 2 x 0 to 10 Vdc outputs and 2 relay outputs
HYVC000M00	expansion board with 2 triac outputs and 2 relay outputs
HYS000F0P0	RS485 serial board
PSOPZKEY00	programming key with battery
PSOPZKEYA0	programming key with power supply
HYKA000000	programming key adapter
NTC010HP02	HP NTC sensor with JST connector L= 1 m single pack
NTC030HP02	HP NTC sensor with JST connector L= 3 m single pack
NTC050HP02	HP NTC sensor with JST connector L= 5 m single pack
NTC010HP0R	HP NTC sensor with JST connector L= 1 m pack of 50 pcs
NTC016HP0R	HP NTC sensor with JST connector L= 1.6 m pack of 50 pcs
NTC030HP0R	HP NTC sensor with JST connector L= 3 m pack of 50 pcs
NTC050HP0R	HP NTC sensor with JST connector L= 5 m pack of 50 pcs

Tab. 7.r

## 7.10 Software revisions

Below is a table with the product software revisions.

The software version can be viewed by accessing parameter 0 (e.g. 10 = 1.0).

revision	note
1.2	
1.3	The parameters that are not pertinent to the application are no longer visible. Saturation limits (set point) added to the compensation algorithm.









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