AXCU22/WMB

Electronic fan-coil controller
with ModBus communication

ISO9001

Contents

CONTROLLI 1936

ISO9001

1. HOW TO USE THIS MANUAL

In order to refer to the manual quickly and easily, customers may find the following useful:

- **Call-outs**
  Call-out column:
  Call-outs on the topics described are placed on the left of the text to allow the user to find the required information quickly.

- **Cross references**
  All the words in *italics* are listed in the index with a reference to the page where they are described with more details; the text below can be an example:
  "activation of the alarm stops the *compressors*"
  The italics indicates that under Compressors in the index there is a reference to the page where compressors are described in more detail.
  If the online Help on the PC is used, the words in italics become proper hyperlinks (automatic links activated by a click of the mouse) that connect the different sections in the manual and allow you to navigate through the document

- **Highlighted icons:**
  Some parts of the text are highlighted in the callout column using icons with the following meanings:

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

Suggestion: highlights a suggestion that helps users to understand and use the information on the topic described

Attention! : it highlights:

1. information that may <u>damage the system or place persons, equipment, data, etc at risk</u> if not known. These sections must always be read prior to use.
2. a specific topic that users should take into account <u>so that the system does not malfunction or is used improperly.</u>

CONTROLLI 1936

ISO9001

2. INTRODUCTION

AXCU22/WMB is an electronic fan-coil controller designed to control valves with on-off actuators, electrical heaters if present and the three fan speeds. Once the unit has been set correctly, it controls the following fan coil units:

- 2 pipes
- 2 pipes with *electric heaters*
- 4 pipes
- independent wall thermostat
- ceiling-mounted installations
- floor-mounted fan coil installations

In all cases, automatic control of the three fan speeds based on the offset between the ambient temperature and the set point.

Typical applications

- Household
- Residential
- Small commercial areas (offices, hospitals, hotels) **for centralized control of small systems**

Main characteristics

- One family that is now even more comprehensive with a simple modern design
- One controller for a variety of system and machine requirements;
- Easy to use and install
- Less risk of damaging electronics
- Maximum focus on comfort and energy savings
- *Hot Start*
- *Too Cool*
- *Post ventilation*
- *Periodic Ventilation*
- Economy Input or Window Contact
- Automatic fan speed
- Low noise level with solid state technology
- Control of range…..
- Ventilation selectable in dead zone
- Remote air probe (optional accessory)
- Vertically installed for easier on board-*installation*
- Operating and probe alarm *LEDs*

ISO9001

2.1 Interface

Knob
- Gamma Set point: parameter-configurable + and –
- plugs to limit set point range or block it at a specific value

Slide switch*
- 1 fan switch to control fan speed: High/Medium/Low/Auto

LEDs
- *Heating* LED **(red)**
- *Cooling* LED **(green)**
- Thermostat request LED **(yellow)**

NOTE: * Slide switches are also referred to in the text as *Sliders*
** *Heating* is referred to as **HEATING** or **WINTER** mode
*** *Cooling* is referred to as **COOLING** or **SUMMER** mode

2.2 Example of Fan-coil installation

Typical 2 and 4 pipe fan-coil installations are illustrated below:

2 pipe installation
2 pipe fan coil
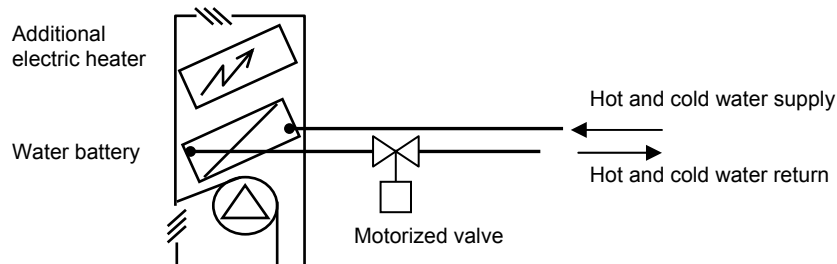
4 pipe installation
4 pipe fan-coil
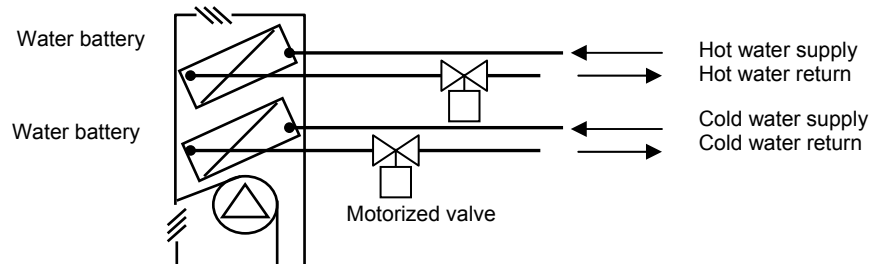
DELIVERY FAN:
Fan control
The fan is located just before the *finned battery*; and it takes back the room air via the inlet air duct.
The air flows across the batteries before being released into the room.
If the control is installed on the fan coil unit itself, an additional return air sensor, positioned in the flow of inlet air detects the room temperature. In this case, the temperature measurement is valid only if the flow of inlet air is sufficient to nullify or reduce stratification phenomena in the room.

WATER BATTERY – MOTORIZED *VALVE*
Finned battery
Consists of a water-air exchanger, located internally, across which the inlet air travels.
Hot or cold water, produced by a boiler or a chiller, flows through the exchanger.

CONTROLLI 1936

ISO9001

Valve
There may be a dual battery supply circuit (4-pipes); the 4-pipe configuration may be set up with two motorized valves and two independent exchangers, or with a single exchanger (2-pipes). In some cases it is important to be able to measure the temperature of the water supplied to the battery, which may be done with a water sensor located downstream of the battery's return and the valve.

ELECTRIC HEATERS
The electric battery may be used to heat air in 2-pipe systems when there is only cold water available (electric heaters in regulation), or to assist heating using water when room temperature is far from set-point (2nd step electric heaters in integration).

2.3 Technical Characteristics

Model	FC U32W/B
Application	
2 pipes	*
2 pipes with integrated *electric heaters*	
2 pipes with regulated *electric heaters*	*
4 pipes	*
Installation	
Wall-mounted	°
Device-mounted – ceiling	*
Device-mounted – floor	*
Inputs/Outputs	
Digital Inputs	1
Air probe	1
Remote air probe (not supplied)	1
Remote water probe (not supplied)	1
230Vac Triac *outputs* FAN	**3 (1 A max)**
230Vac Triac *outputs VALVE*	**2 (0.5 A max)**
LEDs	**3**
Functions	
Hot Start	
Too Cool	
Window Contact	•
Operating/probe alarm *LEDs*	•

Notes:
- compatible

* dip-switch selectable
** only if remote water probe is present
° machine configuration (wall-mounted) automatically identified if the remote air probe is not installed

Characteristics common to all models

- *Functions*
- manual change-over
- *automatic change-over*
- *Post ventilation*
- *Periodic ventilation*
- Automatic speeds
- Control of set point
- Ventilation in dead zone (*)
- Regulation on valves/fans

(*) dip-switch selectable

CONTROLLI 1936

ISO9001

3. INSTALLATION

Wall-mounted AXCU22/WMB is composed by two different parts:
- the first part (connector base plate) contains connectors only, and it is anchored to the wall;
- the second part (main interface) contains all electronics and controls, and can easily be fitted onto the first part
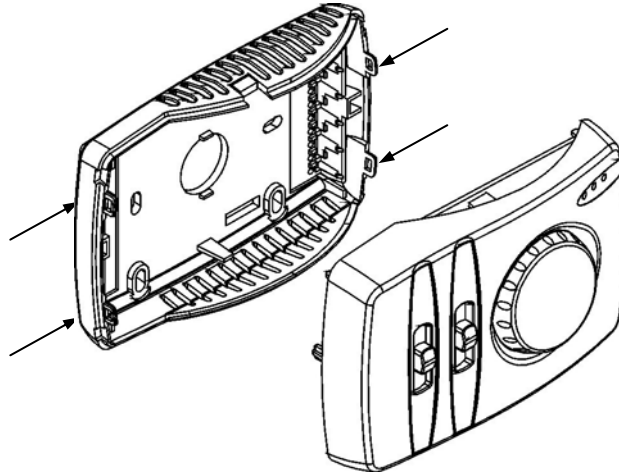
This set-up permits easy installation with no danger of damage to electronic components.
To separate the connector base plate from the main interface, use a tiny screwdriver, insert the screwdriver into the appropriate holes (at the side of the housing), wrest gently till both parts are separated.

AXCU22/WMB can also be installed inside the fan-coil unit. An additional remote air sensor needs to be mounted in the return air flow on the unit.

3.1 Warnings

INSTALLATION MUST BE CARRIED OUT BY QUALIFIED PERSONNEL ONLY!

- In case of doubts on the functions performed by the device please contact our Technical Dept.
- Before installation, always read the labels fitted on the device.

Parts which are under hazardous voltage must not be accessible under regular operating conditions.
The device must be adequately protected from water and dust.
Do not install the control in environments with the following characteristics:

- Relative humidity (non-condensing) over 90%
- Strong vibrations or shocks
- Ongoing exposure to jets of water under pressure
- Exposure to aggressive, polluting atmospheric agents which could cause corrosion or oxidation (such as sulphuric or ammoniac substances, salt mists, fumes)
- Presence of considerable magnetic or radio interference (such as transmission antennas)
- Exposure to direct sunlight or atmospheric agents.

When connecting up controllers to each other, or to accessories, electric loads or other devices, take great care in relation to the following:

- Incorrect connection to power supply voltage could damage the controller.
- Use appropriate cable terminals. Slack the terminal screw, insert the cable terminal, and then tighten the screw again. Check that it is tight by pulling gently on the wire. Do not use an automatic screwing machine (or use with a torque setting of less than 50 N*cm).
- Possible electromagnetic interference: wire up low voltage utilities separately from high voltage utilities. Keep temperature sensor cables and digital inputs separate from cables with inductive loads or power cables as much as possible.
- Never wire power cables and temperature sensor cables through the same conduit. The remote sensor wires must be kept far away from power devices (such as power *TRIAC*). Make sure the route travelled by these cables is as short as possible.
- Never apply to outputs loads which are higher than those specified herein.
- Observe *connection diagrams* carefully when connecting up loads.

CONTROLLI 1936

ISO9001

3.2 Mounting

Controller has to be installed in a place which:

- Ensures easy access for operation
- Is free of curtains, cupboards, shelves, etc…
- Ensure free circulation of air
- Is free from direct sunlight
- Is free of draft (e.g. open window or door)
- Is not directly affected by a heating or cooling source
- Is not mounted on an outer wall
- Is mounted on the wall at approx. 1,5 m from the floor mounting

3.3 Connection diagrams

Loads must be connected up to the AXCU22/WMB as shown below:

Terminal board
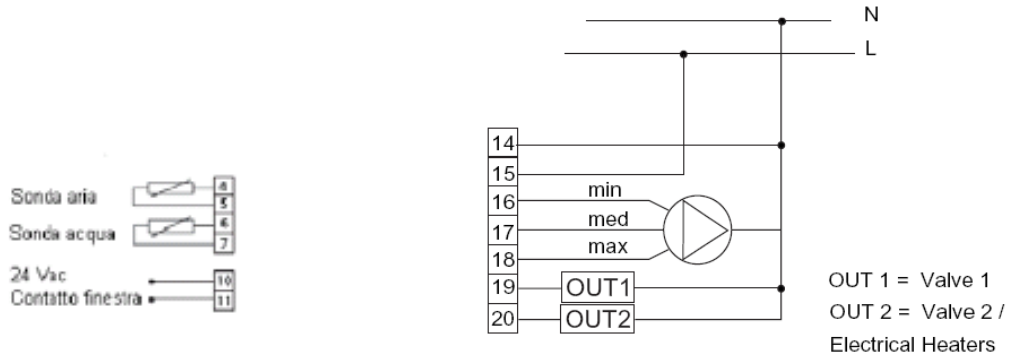
OUTPUT	APPLICATION		
	2-pipe only	**2-pipe with electric heater**	**4-pipe**
OUT1	Heating/Cooling *valve*	Heating/Cooling *valve*	Cooling *valve*
OUT2	Not used	Electric heaters	Heating *valve*

3.4 Analogue inputs

There are three analogue inputs available:

Number	Description	**Probe** range	**Measurement** range
ST1	Ambient temperature probe (always internal) Probe mounted on board in wall-mounted installations.	-50°C +100°C	-50°C +110°C
ST2	Optional sensor; it inhibits operating of ST1 if present. Used for regulating ambient temperature, it is mounted on the device in ceiling-mounted or floor-mounted installations. For information on *connections*, see diagram.	-50°C +100°C	-50°C +110°C
ST3	Optional probe; it enables *Hot Start* and *Too Cool functions* when present. This sensor, which must be installed on the downstream side of the water *valve*, is used to control the water temperature.	-50°C +100°C	-50°C +110°C

CONTROLLI 1936

ISO9001

Note: inputs 1 and 2 are expressed to the nearest ten degrees Celsius with reference to O (zero) Celsius.

If the measurement range is exceeded, the probe is considered faulty.
Measurement resolution is 1/4 di C°.
Measurement error is:
- less than 1°C between +5°C and 50°C;
- less than 2°C between -20°C and 100°C;

Number	Description	Use
ST1 (selector knob)	Potentiometer input: Used to set the controller set point. Ranging from a minimum set point of 5 C° to a maximum set point of 35 C°.	-105° +105° from average point

Note: The presence of the water sensor is automatically detected by the controller during power start-up.
This means that *functions* like temperature driven *Hot start*, centralised On/Off (only 2-pipe models), periodic *valve* opening (only 2-pipe models) will be activated or not, depending on the presence of the water sensor.

Water sensor mounted upstream
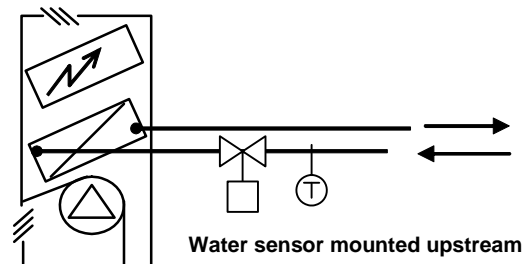
The water sensor (*analogue inputs*) should always be mounted on the water pipe, upstream of the *valve* and as close as possible to the battery. On a 4-pipe system, it must always be mounted on the hot water circuit, never on the cold water circuit.

3.5 Digital outputs

Digital outputs consist of 3 TRIAC

Number	Function	Description
FAN	Control of Outlet Fan (see Operating of fan on demand)	Starts ventilation. The fan control cursor takes the phase to three different terminals so that the 3 fan speeds can be manually selected.
OUT1	*Valve* Control	Allows water to flow into the coil.
OUT2	Control of *valve* or *electric heaters*	If the electric heater coil is present, the TRIAC controls if. If not, it is controlled in the same way as the second *valve* on a *4 pipe system*.

TRIAC

CONTROLLI 1936

ISO9001

3.6 Dip Switch

The back of the electronic board (see photo) has **6** dip switches, the *functions* of which are listed below:
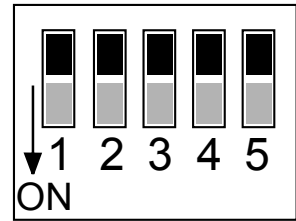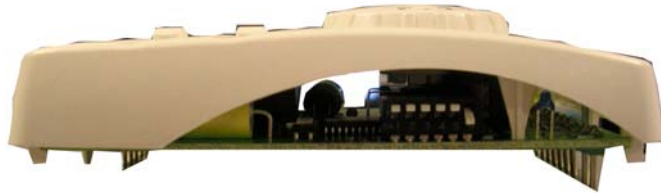
DIP 4-5

Dip Switch no.	5	4	Description
	OFF	OFF	2 pipe device without *electric heaters*
	OFF	ON	4 pipe device
	ON	OFF	2 pipe device with control *electric heaters*
	ON	ON	2 pipe device with integrated *electric heaters*

DIP 3-2-1

Dip Switch no.	ON	OFF	Description
3	x		thermostat control on *valve*
		x	thermostat control on fan
2		x	ventilation on demand
	x		continuous ventilation
1		x	floor-mounted device
	x		ceiling-mounted device

3.6.1 AHU Characteristics

DIP 4-5

Dip Switch no.	4	5	2 pipes	4 pipes	Electric heaters	Fan speed	Heating	Cooling	Electric heaters
	OFF	OFF	x	-	-	3	OUT1	OUT1	-
	ON	OFF	-	-	-	3	OUT2	OUT1	-
	OFF	ON	x	-	x	3	-	OUT1	OUT2
	ON	ON	x	-	x	3	OUT1	OUT1	OUT2

NOTE:
- indicates NOT USED

To access the DIP switches, proceed as follows:
- First, use a small screwdriver to separate the connector base unit from the main interface. Place the screwdriver in the special holes (in the side of the casing) and twist slightly until the two parts come apart.
- If you turn the back of the main interface around, you can see the DIP switches installed on the printed circuit board.

CONTROLLI 1936

ISO9001

<u>3.6.2. Dip Switch Configuration</u>

<u>3.6.2.1 Dip 4-5 Configuration</u>
Table A

system	DIP no.	
	5	**4**
2 pipe device without *electric heaters*	**OFF**	**OFF**
4 pipe device	**OFF**	**ON**
2 pipe device with control *electric heaters*	**ON**	**OFF**
2 pipe device with integrated *electric heaters*	**ON**	**ON**

Table B

		Dip Switch Configuration			
		Dip4 OFF DIP5 OFF	Dip4 ON DIP5 ON	Dip4 OFF Dip5 ON	Dip4 ON Dip5 OFF
Type of system	System	2 pipes	2 pipes	2 pipes	4 pipes
	electric heaters	NO	Integrated	Control	NO
Outputs	*Heating*	OUT 1	OUT 1	-	OUT 2
	Cooling	OUT 1	OUT 1	OUT 1	OUT 1
	electric heaters	NO	OUT 2	OUT 2	NO

Dip 5-4
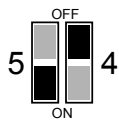
- Dip 5 = OFF   2 pipe device without *electric heaters*
- Dip 4 = OFF
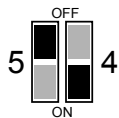
- Dip 5 = OFF   4 pipe device
- Dip 4 = ON

- Dip 5 = ON   2 pipe device with control *electric heaters*
- Dip 4 = OFF

CONTROLLI 1936

ISO9001
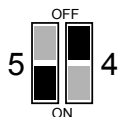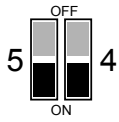
- Dip 5 = ON   2 pipe device with integrated *electric heaters*
- Dip 4 = ON

3.6.2.2 Dip 3 Configuration

Dip Switch no.	ON	OFF	Description
3		x	thermostat control on *valve*
	x		thermostat control on fan
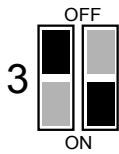
Dip 3

- Dip 3 = OFF   thermostat control on fan
- Dip 3 = ON   thermostat control on *valve*

3.6.2.3 Dip 1-2 Configuration
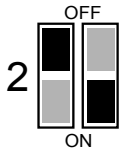
- Dip 2 = OFF   ventilation on demand
- Dip 2 = ON   continuous ventilation
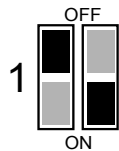
- Dip 1 = OFF   floor-mounted device
- Dip 1 = ON   ceiling-mounted device

CONTROLLI 1936

ISO9001

4. USER'S INTERFACE

AXCU22/WMB has three main controls:
- Graduated knob
- 2 sliders

4.1 Graduated set-point knob

Potentiometer for setting operating set point.
Operating set point is altered on the basis of the angle set, from 5 to 35 Celsius.
Excursion from the potentiometer centre point is an angle of +/- 105°.

4.2 Sliders

2 sliders are available, one to start up or stop the device, the other to control fan speed:
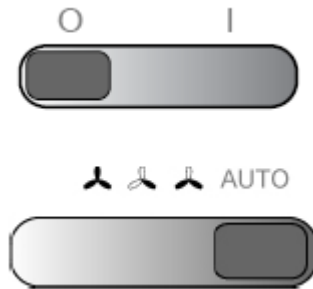
4.3 Regulation

The desired temperature can be regulated and set using the selector knob on the instrument keypad.

4.4 Operation

Thanks to the slider on the front of the device it is possible to start up or stop AXCU22/WMB.
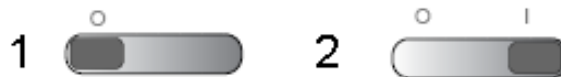
1. Device ON
2. Device OFF

In the same way you can choose between 3 different fan speed (Low /Medium/High)or Auto function:

1. Fans at maximum speed
2. Fans at medium speed
3. Fans at minimum speed
4. Automatic selection setting

CONTROLLI 1936

ISO9001

4.5 Fan slider

Position 1/2/3:
Switches the phase selected by the fan TRIAC to three motor windings to give three different fan speeds: High/Medium/Low

High speed:	**Medium speed.**	**Low speed:**

Position 4:

Indicates automatic speed (AUTOFAN) See relevant chapter

AUTO

4.6 LED

Three LEDs are used to indicate the actual mode:

- **On LED: (YELLOW)**
  Fix on during operation;
- **_Cooling_ LED: (GREEN)**
  Lights up if there is a request for _cooling_ and in the Dead Zone.
  Blinking: means that the thermoregulator has not been satisfied, but the consent from water probe in order to start up the fan is missing.
  Fixed on: _cooling_ available (both fan and _valve_ are working).
- **_Heating_ LED: (RED)**
  Lights up if there is a request for _heating_ and in the Dead Zone.
  Blinking: means that the thermoregulator has not been satisfied, but the consent from water probe (2-pipe) in order to start up the fan is missing (**look at _Hot Start_**).
  Fixed on: _Heating_ is available (fan, _valve_ and/or electric heater are working).

- All **LEDs** blink for 3 seconds when controller is electrically supplied.

Alarm indication

All LED's continuously Blink to indicate an alarm status. An alarm will be generated if one of the sensors is damaged, disconnected (some models mandatory need the water sensor), or short circuited, until the problem has been solved.

Function	LED1 YELLOW	LED2 GREEN	LED3 RED
Cooling plus thermostat request	ON	ON	OFF
Heating plus thermostat request	ON	OFF	ON
Operating in Refrigeration mode	OFF	ON	OFF
Operating in heating mode	OFF	OFF	ON
Hot Start on	ON	OFF	flashing
Too Cool on	ON	flashing	OFF
Probe error	flashing	flashing	flashing

CONTROLLI 1936

ISO9001

5. CONNECTIVITY

5.1 Installation of RS-485 Network

5.1.1 Installation of RS-485 network - note 1

Use shielded and "**twisted**" cable with two 0.5 mm^2 conductors, plus earth braid (i.e. Belden cable model 8762 with PVC sheath, 2 conductors plus braiding, 20 AWG, nominal capacity between conductors 89 pF, nominal capacity between one conductor and shielding 161 pF).
For cable laying, comply with the regulations on data transmission systems (EN 50174).
Special care must be taken to ensure that the data transmission circuits are kept separate from the power lines.
The RS-485 network that can be directly connected to the device is 1200 m long with a maximum of 32 instruments.
The length of the network and number of instruments for each channel can be extended using special repeater modules.

5.1.2 Installation of RS-485 network - note 2

Two types of instrument terminal blocks can be used:
- single with 2 conductors: only use "+" and "–" conductors, maintain "gnd" conductor continuity (braiding).
- single or double with 3 conductors: use all 3 conductors ("+" ,"–" for signal and "gnd" for braiding).

5.1.3 Installation of RS-485 network - note 3

Insert the 120 (Ohm) 1/4W resistors between the "+" and "–" terminals on the interface and last unit in the network.

5.1.4 Programming addresses for the RS-485 network

- **Assign an address to each device:**
  the address is defined by parameter PA29 and factory-set (1=Modbus)

- **ModBUS network**
  range of available addresses 1…255 (NOTE: max 32 instruments*)
  address =0 "By BROADCAST" see ModBUS manual

5.2 Network (ModBUS protocol) – single device

SINGLE POINT-SHORT DISTANCE connection , i.e. with a single device connected and fixed length (usually less than one meter).

NOTE: If several AXCU22/WMB devices are set or configured, they must have a univocal address.**

Network (ModBUS protocol) single device

CONTROLLI 1936

ISO9001
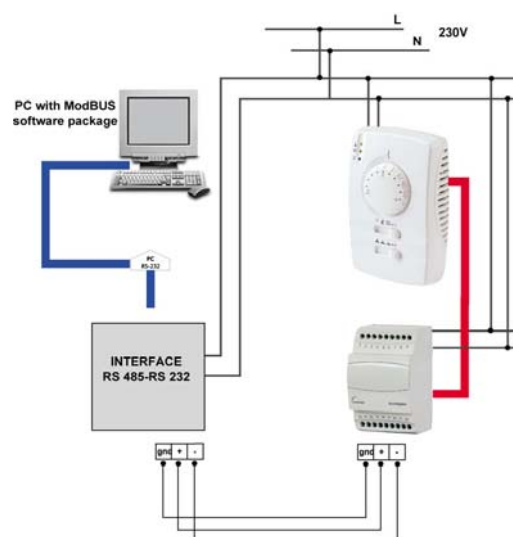
5.3 Network (ModBUS protocol) – more devices

MULTI POINT-LONG DISTANCE connection , i.e. with several devices connected in an RS-485 network and length NOT fixed.
If this is the case, an RS-485 network must be wired following the indications at the beginning of the section.

NOTE: The devices must have a univocal address.**

CONTROLLI 1936

ISO9001

6. TEMPERATURE CONTROL FUNCTIONS

Auto

AXCU22/WMB is configured to switch automatically (*Auto*) from *cool* to *heat* mode and vice versa. Depending on the temperature detected by the water sensor (2-pipe system) or air sensor (4-pipe system or 2-pipe with INTEGRATED AND AUTOMATICALLY ADJUSTING *electric heaters*).

The utilities controlled in the different operating modes are shown in the table below:

Operating modes table

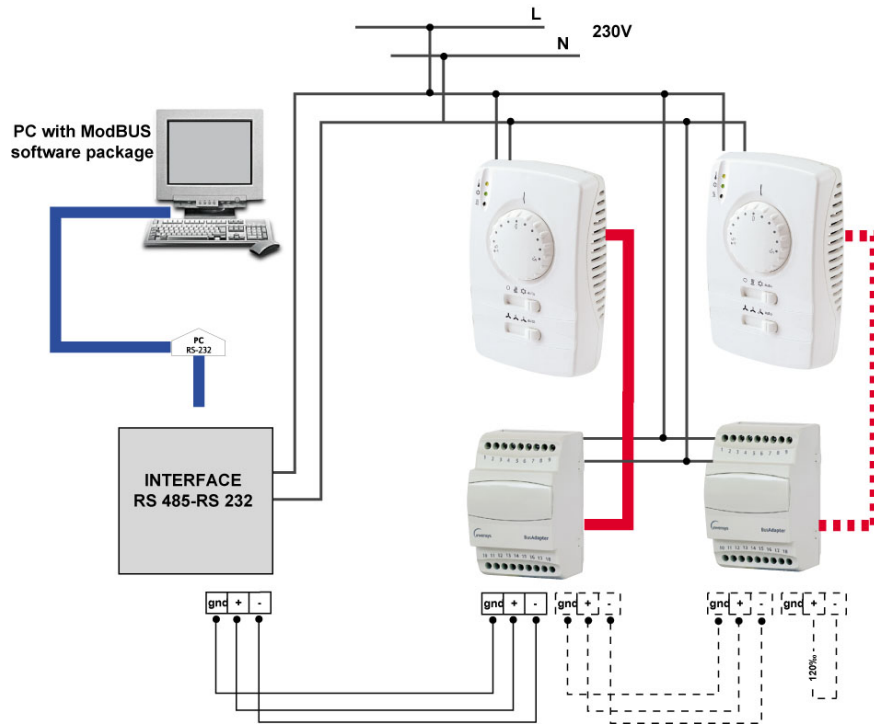| Mode	Setting	Controlled utilities
HEATING	MANUAL	• *Valve*: water (for 2-pipe fan-coil), hot water (for 4-pipe fan-coil) • Fan (3 manually set speeds) • Electric heater
COOLING	MANUAL	• *Valve*: water (2 pipes), cold water (4 pipes) • Fan (3 manually set speeds)
AUTO	AUTOMATIC	Dynamic operation in the following modes: • HEAT • COOL • "STAND BY" condition (Summer- Winter), on the basis of comparison of water temperature with set point setting • «OFF» (dead zone), depending on the difference between air temperature and set point temperature.

Automatic DEAD ZONE change-over

If the operation mode is selected automatically depending on the difference between ambient temperature and the set point temperature, this is referred to as an automatic DEAD ZONE change-over with lateral band

Switching between heat and cool settings takes place automatically as illustrated below.
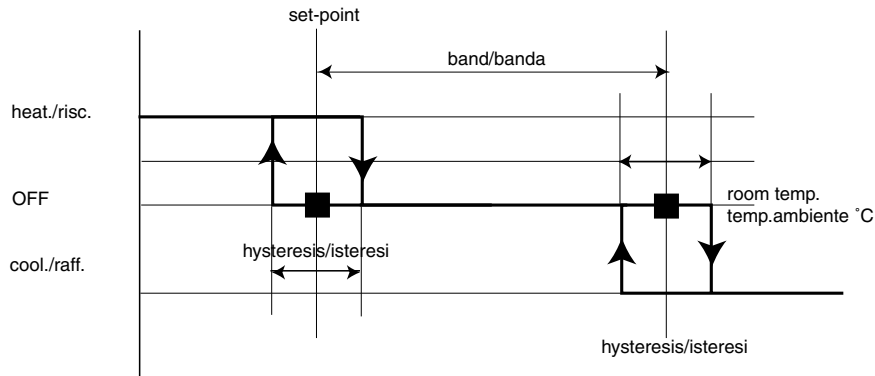
6.1 Regulation algorithm

AXCU22/WMB controls the loads according to a set point that can be set using the knob with 5…35°C range

6.1.1 Thermostat control on valve

Here, fan control varies according to the operating mode selected (Cool or Heat) and behaves as follows:
   A. in Cool mode, the fans operate at the speed selected by the fan *slider* or set by the Autofan controller and they are never deactivated unless the *Too Cool* function intervenes; the speed is the one selected by the fan *slider* (controlled in *AUTO* mode if *AUTO* has been selected)
   B. in Heat mode, the fan follows the *valve* state (observing the activation delay time) and behaves as follows:
       i.   fan ON 60 seconds after the *valve* open command (signalled by flashing of the red LED);
       ii. fan OFF when *valve*close command is given.
       iii. the *HOT START*, *POST VENTILATION* and *PERIODIC VENTILATION* functions are also activated (since the probe is located on the upstream side of the *valve*). **(see *Functions* section)**

HEAD B VALVE

Hysteresis

ON / OFF

temperature C

Setpoint C

COOL A VALVE

Hysteresis

ON / OFF

temperature C

Setpoint C
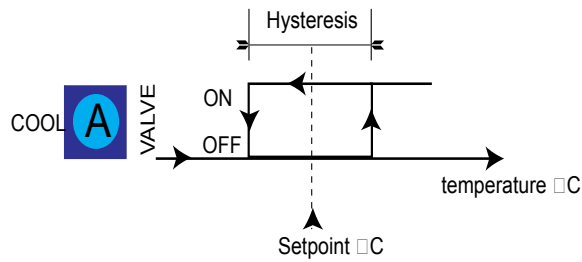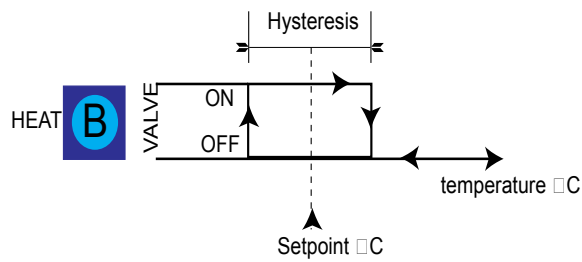
→**IF the water probe is PRESENT:**
The stop fan in *heating* mode function (*Hot Start*) will obviously always be on for water temperatures below P 08°C and the red LED will flash on and off.
If the controller is ON (fans on), the speed will be:
- manually set by the user (Min – Med – Max speeds permitted);
- set by AUTO_FAN at automatic speed if the fan *slider* is positioned to Auto mode.

If Dip switch 2 is in the ON position, the *HOT START* function is deactivated and the fan is always on irrespective of the ambient temperature and the water temperature (in Auto Fan operating, the controller prevents the fan being turned off).

6.1.2 AUTO FAN – temperature control on valve

Speed of the fans is automatically controlled according to the offset between the ambient temperature and the temperature set with the set point.
The graphs related to fan control for temperature control on the valve are shown below.
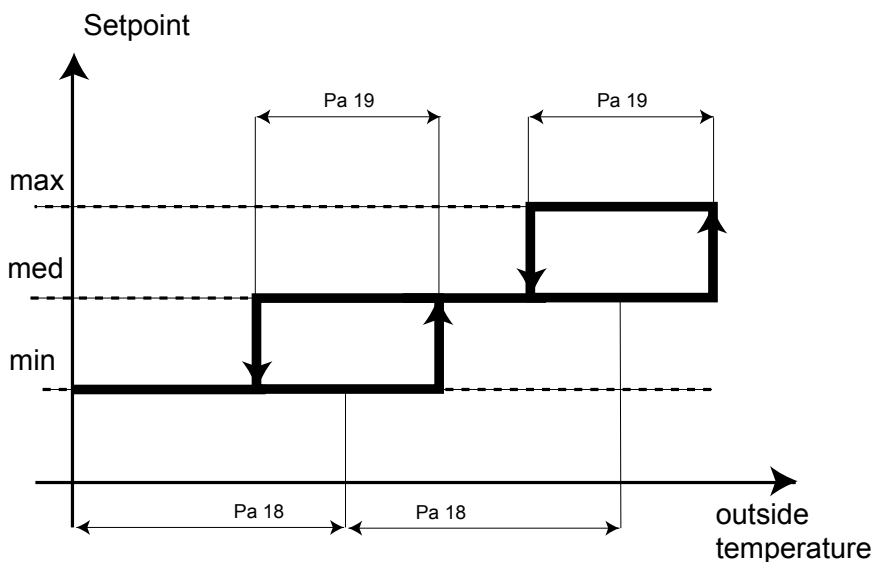
AUTOFAN COOL MODE
temperature
control on valve

AUTOFAN COOL MODE temperature control on valve

Setpoint

Pa 19   Pa 19

max

med

min

Pa 18   Pa 18

outside temperature

CONTROLLI 1936

ISO9001

AUTOFAN HEAT MODE temperature control on valve
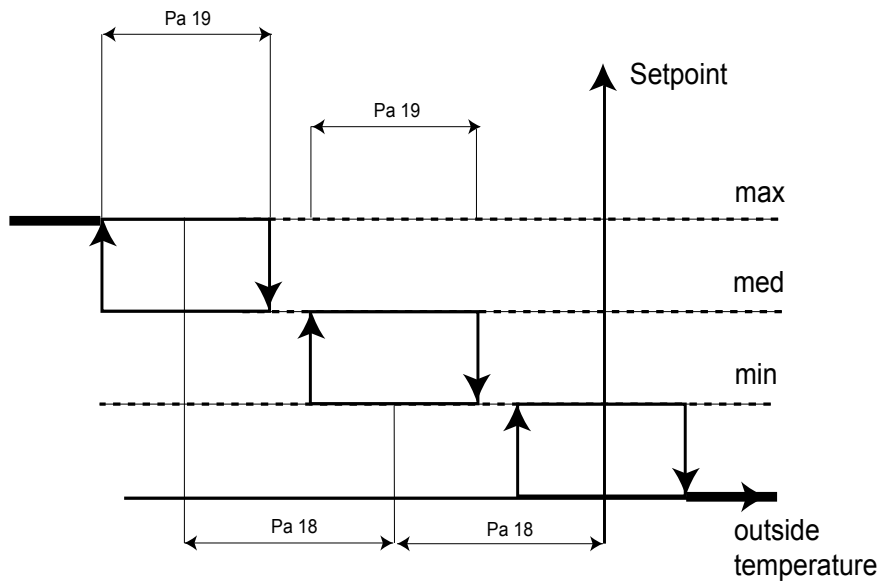
Note: the Set point label in the axis of abscissas in the above graphs refers to the Set point value set by the user using the potentiometer.

The step intervention differential is equal to parameter 18 and the intervention hysteresis equals parameter 19.

6.1.3 Thermostat control on fan

This type of temperature control only uses the fans, the *valve* is not used (the hot or cold water goes into the coil inside the Fan Coil), and the temperature controller works by enabling or inhibiting fan consent (observing the Heat and Cool set points).
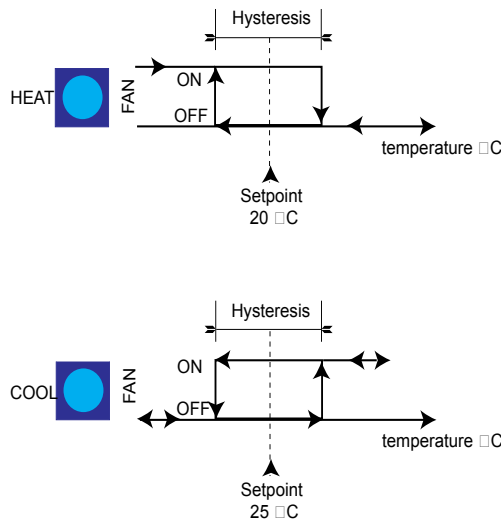
The fans are controlled in the same way as the valves using the same set points and the same hysteresis.
If the controller is ON (fans on), the speed will be:
- manually set by the user (Min – Med – Max speeds permitted);
- set by AUTO_FAN at automatic speed if the fan *slider* is positioned to Auto mode.

With thermostat control on fans the *Periodic Ventilation*, *Hot Start* and *Too Cool* functions are activated. (see Functions section)

CONTROLLI 1936

ISO9001

6.1.4 AUTO FAN with temperature control on fan

Speed of the fans is automatically controlled according to the offset between the ambient temperature and the temperature set with the set point.

**The graphs related to fan control for temperature control on the fan are shown below.**

AUTOFAN COOL MODE temperature control on fan

AUTOFAN HEAT MODE temperature control on fan
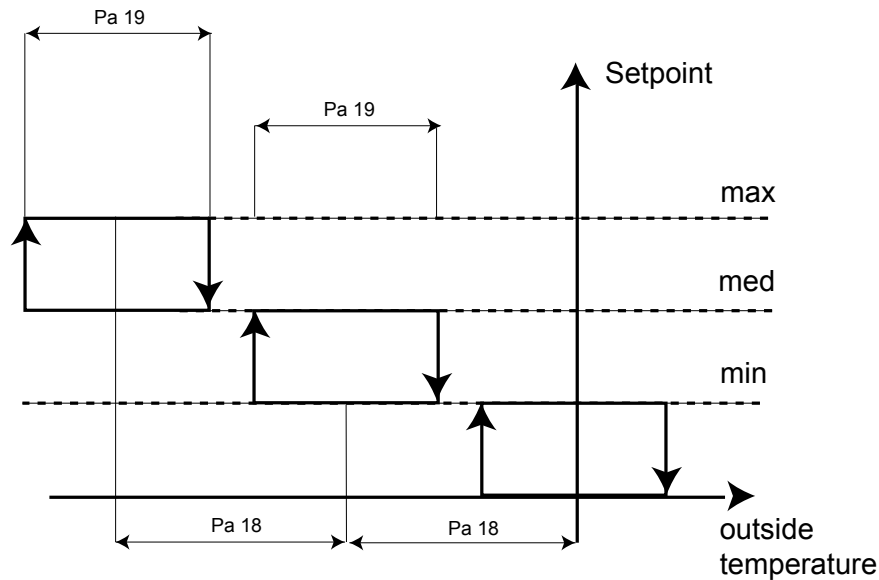
Ventilation with *electric heaters* and *post ventilation*
If the electric heaters are present and activated (both integrated and regulated), the fan speed is forced to maximum speed and the fan must switch itself off with a delay equal to parameter 07 after the last shut down of the electric heaters.

6.2 Load control

Dip Switch 5-4
- 4 pipe device
- 2 pipe device without *electric heaters*
- 2 pipe device with control *electric heaters*
- 2 pipe device with integrated *electric heaters*

The status of *outputs* OUT1 e OUT2 varies according to the type of device:
The status shown in the table refers to when the temperature controller is not satisfied;
if the controller is satisfied, the output marked as ACTIVE in the table would be INACTIVE.

type of machine	output (OUT)	HEAT	COOL
2 PIPES Without electric heaters	OUT1	OUTPUT ACTIVE	OUTPUT ACTIVE
	OUT2	-	-
2 PIPES Control electric heaters	OUT1	-	OUTPUT ACTIVE
	OUT2	OUTPUT ACTIVE	-
2 PIPES Integrated electric heaters	OUT1 [VALVE]	OUTPUT ACTIVE	OUTPUT ACTIVE
	OUT2 [RES.]	OUTPUT ACTIVE IF T_{H2O} < Pa 05-Pa06 OUTPUT INACTIVE IF T_{H2O}> Pa 05	-
4 PIPES	OUT1	Not used	OUTPUT ACTIVE
	OUT2	OUTPUT ACTIVE	-

NOTE:
- indicates NOT USED

Electric heaters

Dip Switch 1-2
- 2 pipe device with control *electric heaters*
- 2 pipe device with integrated *electric heaters*

The electric heaters can work
   A.   in Control mode
   B.   in Integration mode
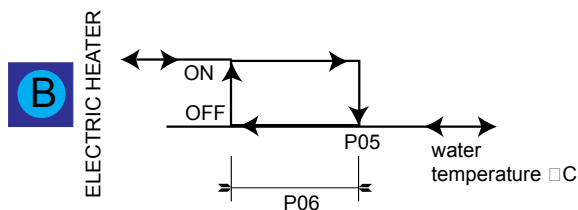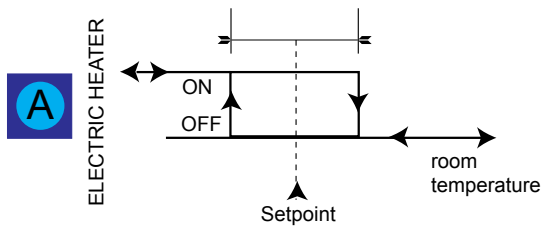
If control *electric heaters* are required, the heat is only controlled by the *electric heaters* and corresponds to the HEAT step on the diagrams **(point A)**
If this is the case, the digital output OUT2 is used to drive (indirectly using a suitable relay) a electric heater coil.

If integrated *electric heaters* are to be used, the controller will use **(point B)**
- water and electric heaters if the temperature of the H_2O is lower than Pa 05 – Pa06 (°C);
water if the temperature of the H_2O is higher or equal to Pa 05 °C; hysteresis equal to Pa 06 °C is applied
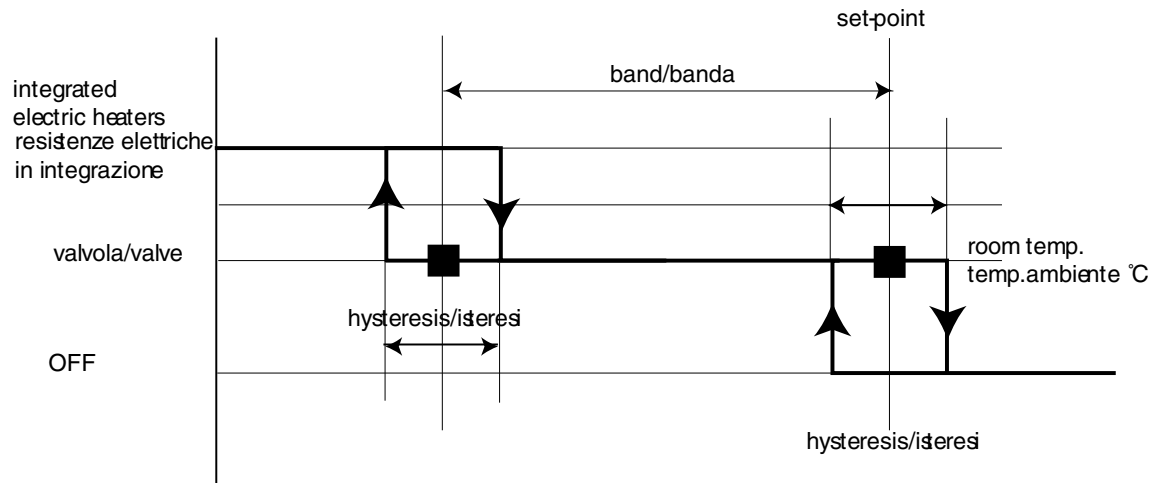
7. FUNCTIONS

7.1 Automatic Change over

Type of system
- 2 pipe device
- 4 pipe device

Mode
- *Heating/Cooling*

- The *Automatic Change-over* function **(AUTO-CHANGE OVER)** automatically selects the *Heating/Cooling* mode according to the ambient temperature and enables the controller to control machine operating independently.
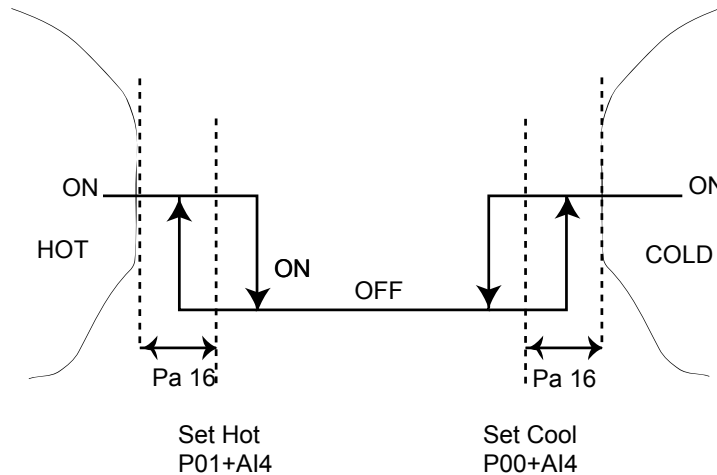
(**)
- The Heat mode is selected if:
  value read by the ambient probe (control or remote) < **Heat** set point *for change-over* (according to set point in *Heating* + delta changeover)

- The Cool mode is selected if:
  value read by the ambient probe (control or remote) < **Cool** set point *for change-over* (according to set point in *Heating* + delta changeover)

As soon as the machine goes into Auto *Change Over* mode (at start-up or from another mode) ventilation is forced into medium speed with duration set by the parameter (fan duration for change-over).
- during ventilation all resources (except for fans) stay OFF;
- the *LEDs* stay as they were for the previous state.
When ventilation is completed, the controller establishes which mode to go into according to **.

If the temperature value falls within the "dead zone", the controller will remain in the mode that it was in prior to the selected phase.
If the main temperature controller is satisfied for a minimum period equal to the change-over delay time *Periodic ventilation**** is effected**.**
When the On period has terminated, the controller verifies the presence of change-over conditions.


***OFF periods specified by P20 (*Automatic change-over* delay)
and On periods specified by parameter P25 (fan duration for change-over),
The fan OFF time meter is reloaded each time the On period is completed and each time the temperature controller is not satisfied; OFF time begins when the temperature controller is satisfied.

If the ambient temperature falls within the dead zone (OFF area on graph) at Power-ON, the board goes into the condition prior to Power-OFF (or if it was in Heat mode, it stays in this condition).
The fans behave in the same way as cases of manual Heat/Cool operating.

Decalibration of Set point (see relevant paragraph)
The temperature controller set points are determined by the decalibration caused by ceiling or floor-mounted installation.
the temperature value for entering a mode refers to the non-decalibrated set point
----

CONTROLLI 1936

ISO9001

7.2 Hot Start

Type of system
- 2 pipe device if no *electric heaters*
- 4 pipe device

Mode
- *Heating*

Dip Switches
- Dip 2=OFF binding condition
- Dip 4=OFF binding condition
-

NOTE: PRESENCE OF WATER PROBE (REMOTE) NECESSARY (see *diagram of water probe mounted downstream*)

The Hot Start function stops cold air from entering the winter operating environment.
Its involves preheating the exchanger (*finned coil*) before activation of fans.
Ventilation will only start when the water probe detects a temperature above (**Pa 08) degrees °C.**
If this does not occur, it waits for permission from the probe.
   If the **WATER** probe is not present (or is faulty):

- the HOT START is ignored and the fans follow normal temperature control.

LED signalling
   While the Hot Start delay is in progress (controlled by the timer or water probe), the red LED (*heating*) will continue to flash quickly.

   Once the delay is over and the fan has started, the red LED remains permanently ON.

Function active if...
This function is only active in *heating* mode.
The Hot Start function controlled by the "temperature" is only available in the models with a water probe for:
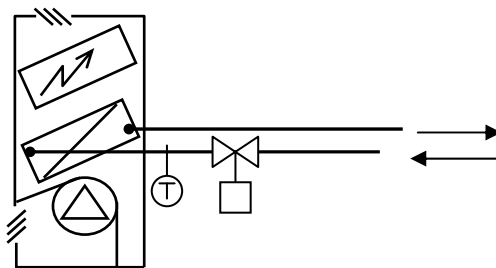- *2 pipe system*s without electric heater
- *4 pipe system*s

Water probe
The water probe (*analogue inputs*) must always be mounted on the water pipe on the downstream side of the *valve* and as near as possible to the coil. In *4 pipe systems*, it must always be mounted on the hot water and not the cold water circuit.

Water probe mounted downstream

7.3 Too Cool

Type of system
- 2 pipe device

Mode
- *Cooling*

Dip Switches
- Dip 4=OFF

NOTE: PRESENCE OF WATER PROBE (REMOTE) NECESSARY (see *diagram of water probe mounted downstream*)

The Too Cool function stops hot air from entering the summer operating environment.
It involves activating the fans when the water temperature is sufficiently cold.
Ventilation will only start when the water probe detects a temperature that is lower than or equal to (**Pa 08) degrees °C.**

If the probe is not present (or is faulty):

- ventilation is activated as in normal temperature control.
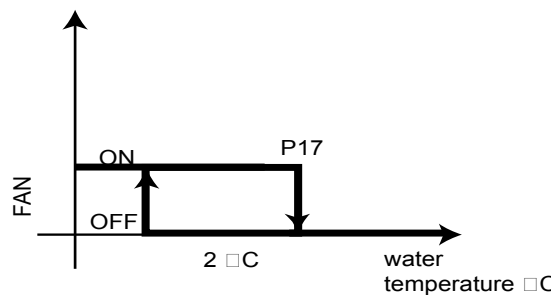
NOTE: There is fixed hysteresis for *valve* control of 2°C

7.4 Blocking Hot-Start and Too- Cool functions from Power –On.

The Too-Cool and Hot-Start *functions* are disabled by default when powering on for the first time
At the first Power-On, irrespective of the water temperature, the fans operate at the speed set by the fan *slider*; the Hot-Start and Too-Cool functions are ignored.
This function allows the installer to test the fans once the machine is installed without having to wait for the water temperature to give permission for them to be activated.
This block is active for approximately 10 minutes.
When the machine is powered, two cases may arise:
- If power supply is cut off while the time is being counted (within 10 minutes), the counter is reset at the next Power-ON and the fans operate as described above.
- If the counter goes to zero (10 minutes or more have elapsed), the Hot-Start and Too-Cool functions remain active even if the device is switched off

7.5 Periodic ventilation

Type of system
- 2 and 4 pipe device

Mode
- *Heating* and *Cooling*

Dip Switches
- Dip 4=OFF

If the ventilation is not activated by a parameter-set period (according to whether it is floor or ceiling-mounted), it is activated for a parameter-set period at the end of the cycle so that the air on the ambient air probe is recycled.
This is to prevent stratification of the air in the premises that would give an inaccurate reading of the air temperature.

CONTROLLI 1936

ISO9001

The tables below indicate the duration and frequency of the cycles;
- during the ON cycles, the fan speed is set to MINIMUM.
- at each change-over (Heat →Cool, Cool →Heat, OFF→ Cool, OFF →Heat) the start-up of the fans is forced to Minimum speed for a parameter specified duration

Fan activation cycles in HEAT Mode

Difference between ambient temperature and set point	Activation cycles	
	OFF	ON
Floor-mounted configuration	Pa 10	Pa 13
Ceiling-mounted configuration	Pa 11	Pa 14

Fan activation cycles in COOL Mode

Difference between ambient temperature and set point	Activation cycles	
	OFF	ON
Floor and ceiling-mounted configuration	Pa 12	Pa 15

7.6 Post Ventilation

Type of system
- *electric heaters* present
- 2 pipe device

Mode
- *Heating*

The fan continues to operate for (Pa 07) minutes after deactivation of the *electric heaters*.
This function prevents overheating in the fan-coil unit and protects the *electric heaters*.

7.7 Set point Decalibration

Type of installation
- ceiling-mounted installations
Mode
- *Heating*

If the ceiling-mounted configuration is selected (with dip-switch 1) the set point in the heat mode is increased by a value equal to (Pa 21)

Type of installation
- floor-mounted installation
Mode
- *Cooling*
If the floor-mounted configuration is selected (with dip-switch) the set point in the cool mode is increased by a value equal to (Pa 28)

7.8 Window Contact

By way of a window contact, the controller can be put on stand-by when the window contact is at 24V~. The aim of this function is to avoid wasting energy when the window is opened by staff.

This function "shifts" the set point as described below.
- In *HEATING* mode (winter setting): the set point is (Pa 27) °C
- In *COOLING* mode (winter setting): the set point is (Pa 26) °C
The contact MUST be energized.

CONTROLLI 1936

ISO9001

8. PARAMETERS

Parameters can be set so that the AXCU22/WMB is fully configurable

Parameters can be changed with:
- PC (if the special connection and dedicated software are available)

8.1 Table of parameters

The following table indicates the AXCU22/WMB parameters referred to in previous sections of this manual.
The controller does NOT have an interface with a display. For this reason, end-users cannot see these values and they cannot be set when the product is being installed UNLESS THEY HAVE A SUITABLE TTL-RS 485-RS232 INTERFACE and a PC with dedicated software (see *Connectivity* section).

- The Number column indicates the sequential number of the parameter
- The Par. column indicates the parameter name
- The Description column indicates the parameter function
- The LOW_LIM and HIGH_LIM columns indicate the minimum and maximum values of the parameter
- The U.M. column indicates the unit of measurement of the parameter
- The Models column indicates the default value (non-modifiable) of the parameter for each model

According to the relevant model, check the default value of the parameter that you want the configuration value for:
e.g. the Economy Set point in *Cooling* (Pa 26) for model FPU32E/S is 28°C whereas it is 35°C for model FPU32W/S

The following table summarizes all the AXCU22/WMB parameters:

Configuration parameters

Number	Par.	Description	LOW_LIM	HIGH_LIM	U.M	
1	PA00	Cooling set point	100	500	°C	22
2	PA01	Heating set point	100	500	°C	20
3	PA02	Cooling/Heating set point offset using selector knob	0	150	°C	8
4	PA03	Hysteresis if built-in air temp. probe is present	0	100	°C	0,4
5	PA04	Hysteresis if remote air temp. probe is present	0	100	°C	0,4
6	PA05	Integrated electric heater set point	100	1000	°C	41
7	PA06	Hysteresis of electric heater in integration mode	0	100	°C	2
8	PA07	Post-ventilation time with electric heaters	0	255	sec	20
9	PA08	HOT START set point	100	500	°C	35
10	PA09	Valve-fan ON delay in Heating mode	0	255	sec	60
11	PA10	Periodic fan OFF time in Heating mode (floor-mounted)	0	255	Min.	10
12	PA11	Periodic fan OFF time in Heating mode (ceiling-mounted)	0	255	Min.	10
13	PA12	Periodic fan OFF time in Cooling mode	0	255	Min.	10
14	PA13	Periodic fan ON time in Heating mode (floor-mounted)	0	255	sec	30
15	PA14	Periodic fan ON time in Heating mode (ceiling-mounted)	0	255	sec	30
16	PA15	Periodic fan ON time in Cooling mode	0	255	sec	30
17	PA16	AUTO mode differential	0	250	°C	2
18	PA17	TOO COOL set point	0	2550	°C	25
19	PA18	Autofan differential	0	100	°C	1
20	PA19	Automatic fan hysteresis	0	100	°C	1
21	PA20	AUTO change-over delay	0	255	Min.	30
22	PA21	Heating set point offset (ceiling-mounted)	0	250	°C	0
23	PA22	Remote air temp. probe offset	-128	127	°C	0
24	PA23	Water temp. probe offset	-128	127	°C	0
26	PA25	Fan time for change-over (AUTO)	0	255	sec	30
27	PA26	Economy set point in Cooling mode	100	500	°C	35
28	PA27	Economy set point in Heating mode	0	500	°C	14
29	PA28	Set point offset in Cooling mode (floor-mounted)	-128	127	°C	-2

CONTROLLI 1936

ISO9001

30	PA29	Device serial address	0	255	Num	1
31	PA43	Modbus Parity (0= none, 1= even, 2=odd)	0	2	Num	1
42	PA38	Remote Heating set point (BMS)	100	500	°C	20
43	PA39	Remote Cooling set point (BMS)	100	500	°C	23
44	PA40	Remote mode/fan settings (BMS)	0	65535	Num	0
45	PA41	Local settings lock (BMS)	0	65535	Num	0

8. TECHNICAL FEATURES

8.1 General Technical data

	Wall-mounted version		
	Typical	**Maximum**	**Minimum**
Supply voltage	230V~	253V~	207V~
Electrical data for 230V output	0.5 A max for valve outputs and 1 A max for fan outputs		
Maximum power consumption	12W	12W	12W
Insulation class	II	II	II
Degree of protection	IP30	IP30	IP30
Operating ambient temperature	25°C	55°C	0°C
Operating ambient temperature*	30%	90%	10%
Storage temperature	55°C	85°C	-20°C
Storage humidity*	30%	90%	10%

8.2 I/O Technical Data

	TOT	No.	THERMOSTAT
Analogue Inputs	3	1	air probe on control
		1	1 remote air probe (optional): cover 4.7 X 27 mm; plastic resin tube; length of cable: 1.5 m
		1	remote water probe (optional): cover 6 X 23 mm; plastic resin tube; length of cable: 2 m
Digital Inputs	4+4	4	SLIM switch inputs (off/summer/winter/auto_mode)
		4	SLIM switch inputs (min/med/max/auto_fan)
Dip Switches	5	5	dip switch
Digital Outputs	5	5	outputs for valve and fan control
LEDs	3	3	LEDs (SUMMER /WINTER/ REQUEST)
Serial	**1**	**1**	**TTL (485 compatible) Eliwell or Modbus standard Protocol**

8.3 Dimensions

120x80x40 mm
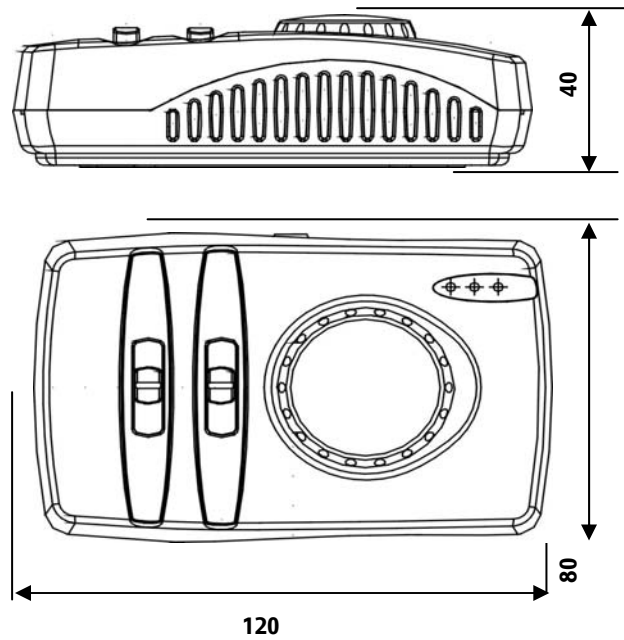
8.4 Declaration of conformity

The device has been designed to be used in electromechanical systems in the air conditioning sector and in devices called fan-coils in particular.
All relevant parts of the directive on low voltage that concern the stated application field must be complied with.

The product complies with the following European Union Directives:
- **EU Directive 73/23/EEC and subsequent amendments**
- **EU Directive 89/336/EEC and subsequent amendments**

and is compliant with the following harmonized standards:
- **LOW VOLTAGE: EN 60730**
- **EMISSIONS: EN 50081-1 (EN 55022)**
- **IMMUNITY: EN 50082-1 (CEI 801-2-3-4-5-11)**

Note1: if the device is used as a component, compliance with the directives is guaranteed for the board but not certification of the machine on which it is installed. The latter is the manufacturer's responsibility.

Note2: since all the electrical parts of the instrument are subjected to dangerous voltage levels (not at low safety voltage, SELV), reinforced probes must be used.

9. USE OF THE DEVICE

Permitted Use

To ensure safety, AXCU22/W must be installed and operated in accordance with the instructions supplied, and access to high voltage components must be prevented under regular operating conditions. The device shall be properly protected against water and dust and shall be accessible by using a tool only.
Any use other than the permitted use is forbidden.

10. RESPONSIBILITY AND RESIDUAL RISKS

Controlli S.p.A. shall not be held liable for any damage incurred as a result of:
- installation/use other than those intended, and, in particular, failure to comply with the safety instructions specified by applicable regulations and/or provided in this document;
- use with equipment which does not provide adequate protection against electric shocks, water and dust under the effective conditions of installation;
- use with equipment which permits access to hazardous parts without the use of tools;
- installation/use with equipment which does not comply with current regulations and legislation.

11. DISCLAIMER

This document is exclusive property of **Controlli S.p.A.**, and cannot be reproduced and circulated unless expressly authorized by **Controlli S.p.A.**.
Although all possible measures have been taken by **Controlli S.p.A.** to guarantee the accuracy of this document, it does not accept any responsibility arising out of its use.

CONTROLLI 1936

ISO9001