AXCU22/W

Electronic fan-coil controller

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ISO9001

Contents

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

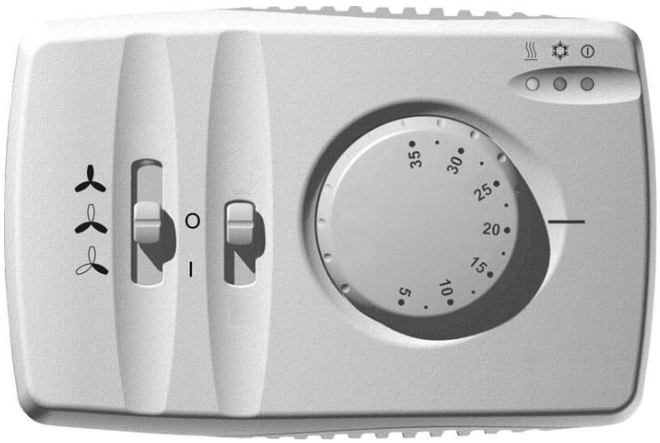
Suggestion: highlights a suggestion that helps users to understand and use the information on the topic described

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>**

2. INTRODUCTION

AXCU22/W is an electronic controller for 2-4 pipe fan-coils. It can control the fan and valves which regulate water flow and can also control a battery of *electric heaters* for winter operation.
It is available in a wall-mounting version very easy to be installed and wired.



A knob on the panel is used to adjust the set point, and two slider switches are used to set

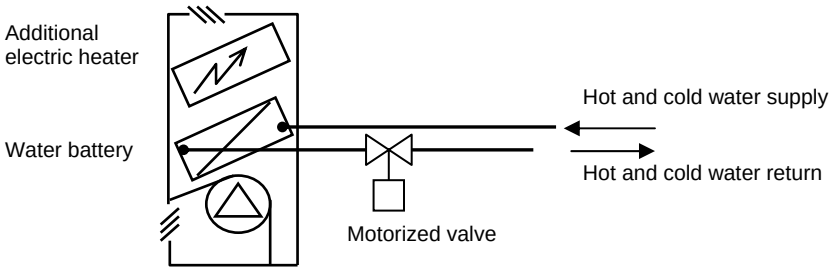
a) the mode
- on/off

b) the fan speed (low/medium/high).

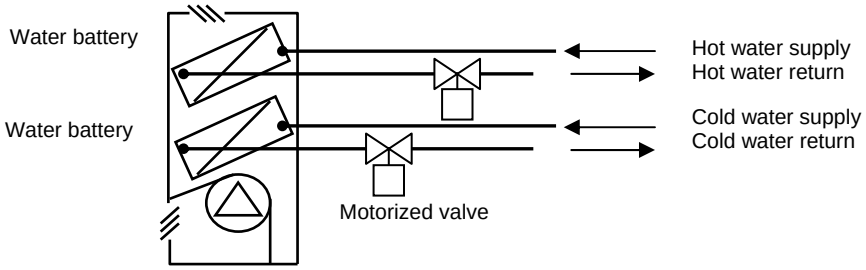
2.1 Example of Fan-coil installation

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.

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*.
(see *Anti valve sticking*)

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).

2.2 Technical Characteristics

Technical Characteristics of the controller are the following:

- 2 and 4 pipe fan coil systems
- Water probe
- Automatic Change-over
- Outputs (water ***valve***) heating and/or cooling *
- *Electric Heaters* *
- Thermo-regulator: heating/cooling or dead zone *
- Hot start drive by timer or temperature
- Window contact input – forst-protection mode

* set by dip switches 4,5 and 6
** set by dip switch 4

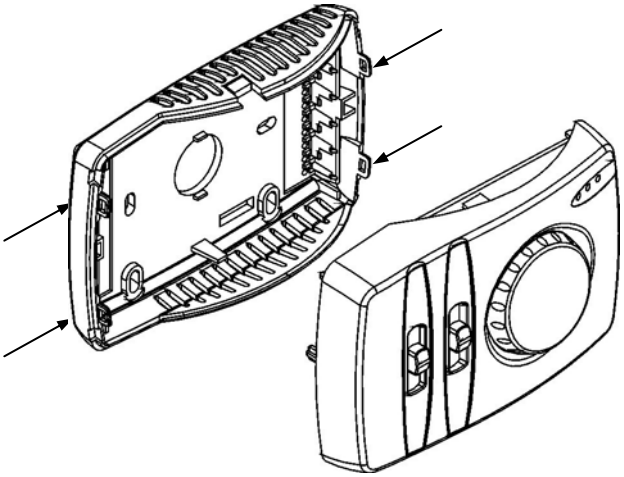
Remote air and water probe:

- SNTC-L: Temperature sensor NTC, plastic cap 7x25, reinforced insulation PVC cable length=1,5m
- SNTC-LS: Temperature sensor NTC, metal cap 6x40, reinforced insulation PVC cable length=1,5m

3. INSTALLATION

Wall-mounted AXCU22/W 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/W 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 *relays*). 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.

3.2 Mounting

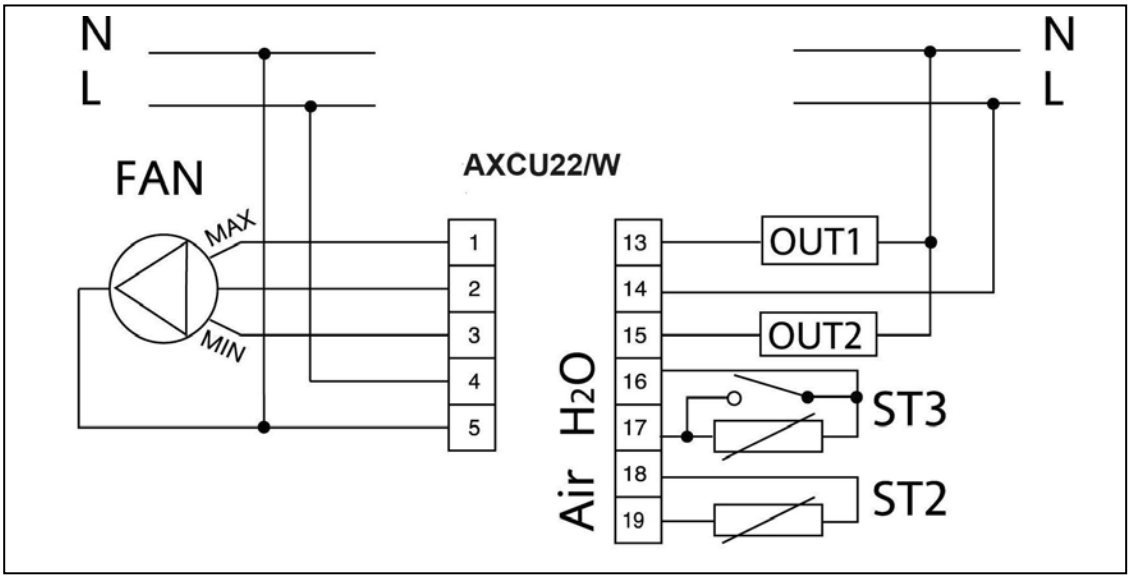
Controller has to be installed in a place which:

- 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

Connections

Utilities must be connected up to the AXCU22/W as shown below:



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

3.4 Analogue inputs

There are three *analogue inputs* available:

Index	Description	Probe range	Meas. range
ST1	NTC sensor input. room temperature **(built-in, always available)** This is the temperature control sensor. It is always integrated on the PCB. The selection to use the local or remote sensor is done through *dip switch* 6. **-->see *dip switch* table**	-50°C +110°C	-10°C +70°C
ST2	NTC sensor input. air temperature: This is the temperature control sensor. It is always integrated on the PCB, but can be an	-50°C +110°C	-10°C +70°C

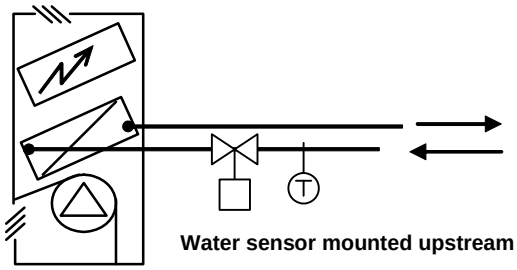
	additional remote sensor, positioned in the return air flow. The selection to use the local or remote sensor is done through *dip switch* 6. **-->see *dip switch* table**		
ST3	NTC sensor input water temperature: This is the sensor used to detect water temperature and it should always be mounted downstream of the *valve*. It is involved in consent and operating *functions*. This input is also used for the *Window contact* input (*connection diagrams*)	-50°C +110°C	-10°C +70°C

PLEASE NOTE: ST2 & ST3 are NOT included in the product package.

Index	Description	Use
(graduated knob)	Potentiometer input: Used to set the controller's operating set point, between a minimum of 5 C° up to a maximum of 35 C°.	-105° +105° from average point

Related topics: *Set point graduated knob* and Range limitation

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.

Relays

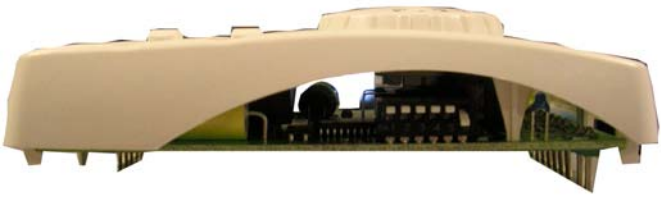
3.5 Digital outputs

Digital outputs consist of 3 *relays*

Index	Function	Description
FAN	Delivery *fan control* (refer to *Fan demand operation*)	Starts ventilation. The *fan control slider* can be used to set the phase on three different terminals to permit manual selection of the 3 fan speeds.
OUT1	*Valve* or electric heater control	If there is a battery of *electric heaters*, this relay pilots it; if not, it is used as a second *valve* for a *4 pipe installation*.
OUT2	*Valve* control	Permits water to flow into the battery.

3.6 Dip Switch

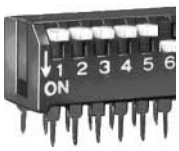
The back of the electronic board (see photo) has **6** *dip switches*, the *functions* of which are listed below:



*** In models with integrated, automatically adjusting *electric heaters*, the HOT function is not available.**

**** The Dip-Switch default setting (factory pre-set) is the following:**

DIP nr.	Description	On	Off	default (factory pre-set)**
6	Air sensor used	Local	Remote	On
5	Fan status in cooling	Thermostatic demand	Always ON	Off
4	Dead Zone value Hysteresis value	5°K 2°K	2°K 1°K	Off
3	Electric heater control	Regulation	Integrated	Off
	time for *Hot Start*	HS=0 (not delayed)*	delayed	
2	2- or 4-pipe system	4-pipe	2-pipe	Off
1	Electric Heater presence	Present	Not present	Off



4. USER'S INTERFACE

AXCU22/W has three main controls and an optional one:

- Graduated knob
- 2 sliders
- 1 *economy slider (optional)*

4.2 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°.

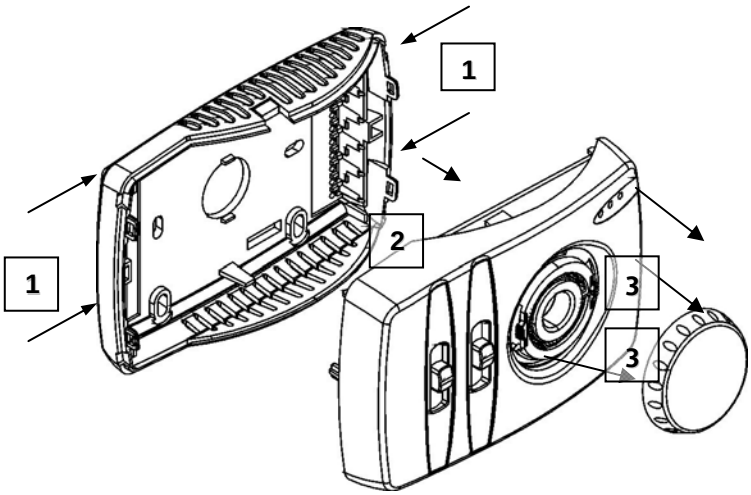
4.2.2 Graduated knob Click stop turning

A sensible click-stop mechanism of approx. 0,5° per position gives the user a more accurate feeling during adjustment.

4.2.3 Range limitation

The set point may be limited by positioning 2 pegs, (plugs) which are mounted under the dial knob, at a specific minimum and maximum value. When the 2 pegs are mounted one next to the other, it is even possible to lock the set point at a specific value.
Please proceed as follows:

1. Separate the connector base plate from the main interface, by using a tiny screwdriver. Insert the screwdriver into the appropriate holes (at the side of the housing), wrest gently till both parts are separated.
2. Before proceeding with the next step, first turn the dial knob to the mid-position when you want to limit (min. / max.) the range. When you want to lock the set point, first turn the graduated knob in the desired lock position value.Turn the back of the main interface towards you and you will see a hole somewhere in the middle of the electronic board. Push gently on the pin connected with the dial knob till it becomes released from the main interface
3. You can now remove the dial knob on the front of the main interface and the *range limitation* becomes accessible. After you entered the pegs in the desired limitation position, mount the dial knob back onto the interface in the correct way.



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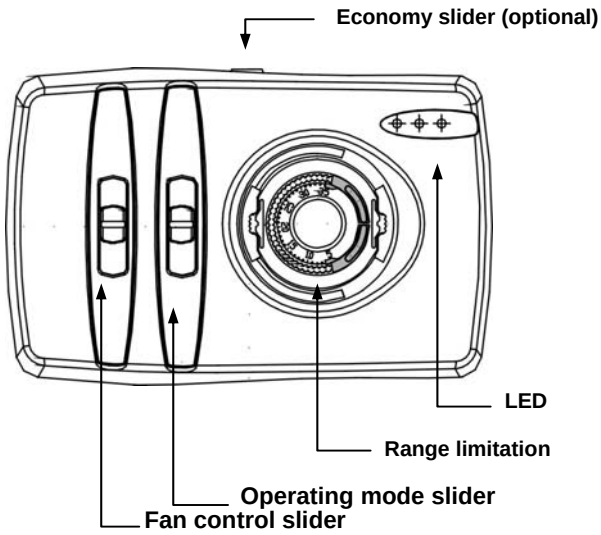
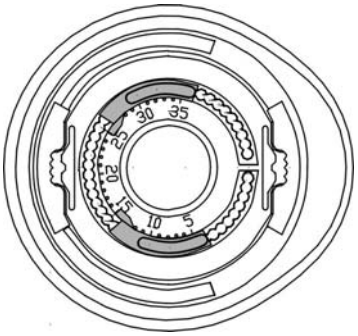
Factory setting of the limitation pegs at 5°C and 35°C:



Example of a range limitation between 15°C and 25°C:



4.2 Fan control slider

Switches the phase sectioned by the fan relay on three motor windings to achieve three different fan speeds: High/Medium/Low.

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

4.3 Economy slider (optional)

Located at the top of the controller and used to operate the *economy* function:

4.4 LED

Three *LED*s are used to indicate the actual mode:

- **On/*economy* *LED*: (YELLOW)**
  Fix on during operation, blinking during *economy* 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 ***LED*s** 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. This will also appear when the *window contact* has been activated (contact closed).

5. TEMPERATURE CONTROL FUNCTIONS

Auto

AXCU22/W 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*).

Operating modes table

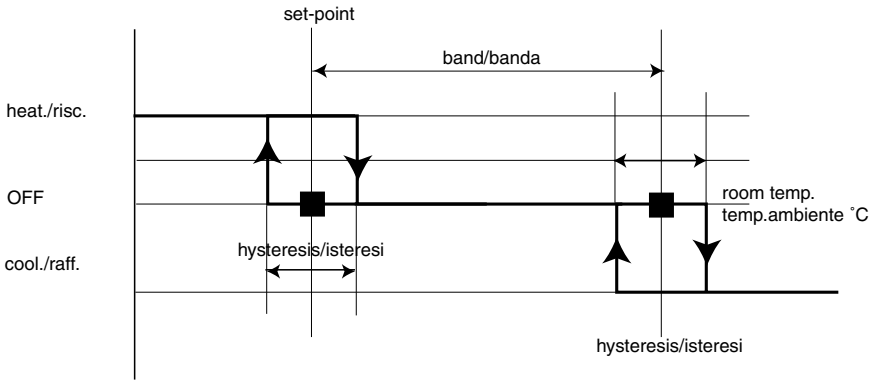
The utilities controlled in the different *operating modes* are shown in the table below:

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 (enabled by *dip switch* dip 1 – universal models only)
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 referrred to as an *automatic DEAD ZONE change-over* with lateral band

Switching between *heat* and *cool* settings takes place automatically as illustrated below.



5.1 Regulation algorithm

AXCU22/W controls utilities on the basis of consents (determined as explained above) and the status of the temperature controller. The latter is a set point function that can be set using the scaled knob.

In a two-pipe *installation* the *regulation algorithm* is configured:
- For the Dead zone if there are *electric heaters* in regulation (or INTEGRATED AND AUTOMATICALLY ADJUSTING).
- For Summer/Winter if there is a water sensor or local selection (refer to *operation mode slider*)

In a four-pipe *installation* the *regulation algorithm* is configured:
- For Summer/Winter, if there is a local heating/cooling selection (refer to *operation mode slider*).
- For the Dead zone, in all other cases.

- Hysteresis and Dead Zone band are determined by *dip switch* 4

5.1.1 Utilities control

- *Operating modes* (*heat* / *cool*) are affected by the consent to the water sensor, if present, for 2-pipe system models. If both water heating and supplementary *electric heaters*, set as integrated source, are both available, the *electric heaters* will be added as a second step separated from the first step by a distance equal to the neutral band (operation of **INTEGRATED AND AUTOMATICALLY ADJUSTING** *electric heaters* is more complex. See the relative section).

- If there are *electric heaters* set as regulation, *heat* is regulated only with *electric heaters* and corresponds to the "*heat*" step in the diagrams.

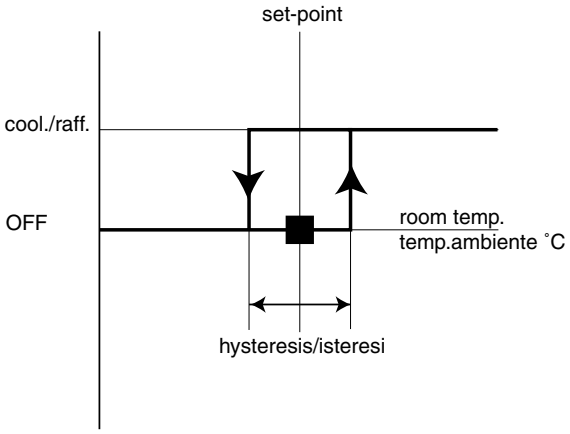
- *dip switch* 5 may be used to select whether the fun has to be ON or OFF once the required temperature has been reached in *cooling* mode; in *heating* mode it will always be OFF.

If there is a water sensor, and it does not give consent for cooling operation and the *regulation algorithm* is set to cooling operation, the fan the fan is switched off respecting the time of 1 minute for *post-ventilation* in the specified cases (see related paragraph).

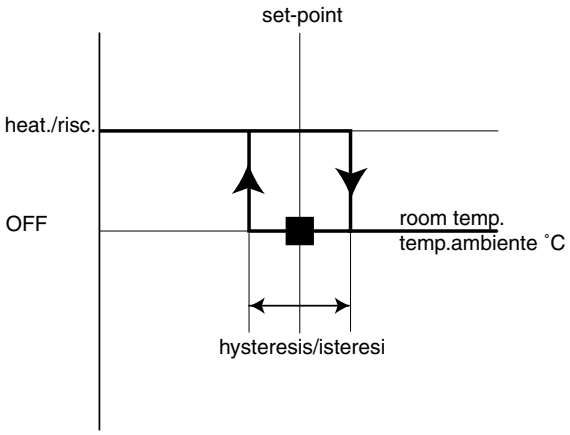
Configurations with no heating/cooling slider (*operation mode slider*) must have four pipes or *electric heaters* set as regulation or a water sensor.

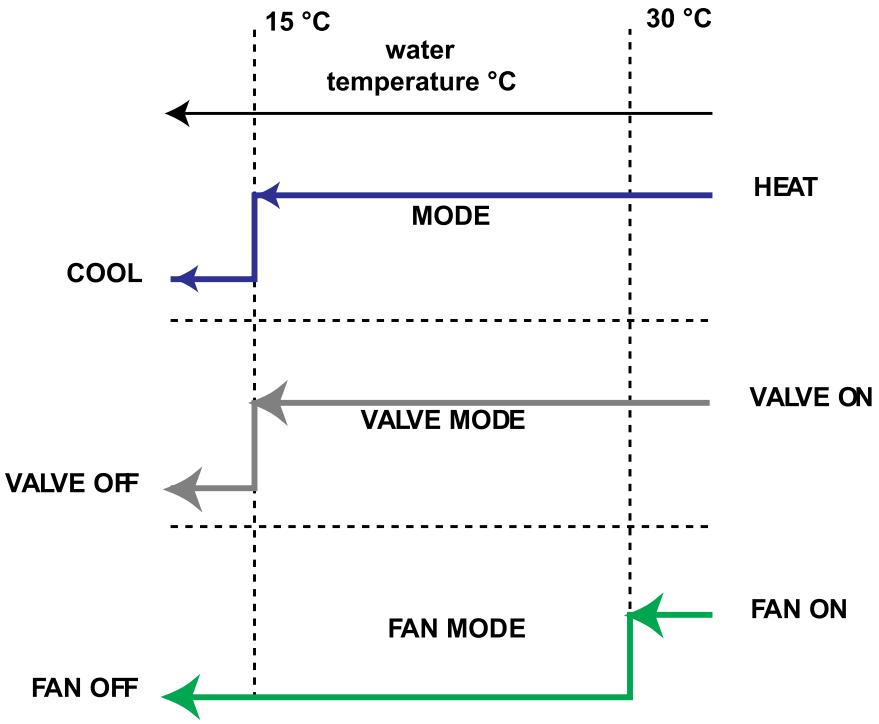
Observe the explanatory diagrams below:

5.2 Regulation algorithm in Heating/Cooling mode



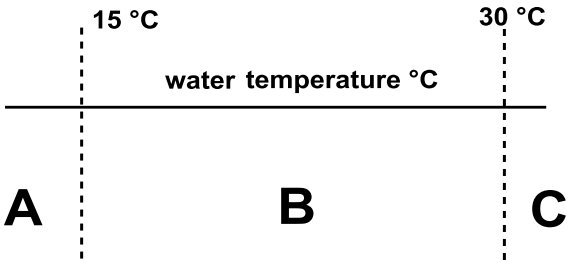
5.2.1 Regulation algorithm in heating mode





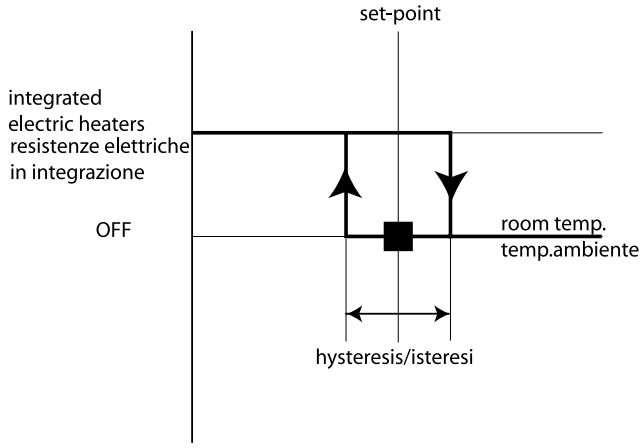
5.2.2 Regulation algorithm in heating mode with supplementary automatically adjusting electric heaters

In models with integrated and automatically adjusting *electric heaters*, heating components are determined by the temperature read by the water probe as well as always being subject to the consents programmed for this sensor.
With this configuration, the *automatic change ov* always takes place at the air probe temperature (Dead Zone). Setting depends on water temperature, as shown in the following three examples:

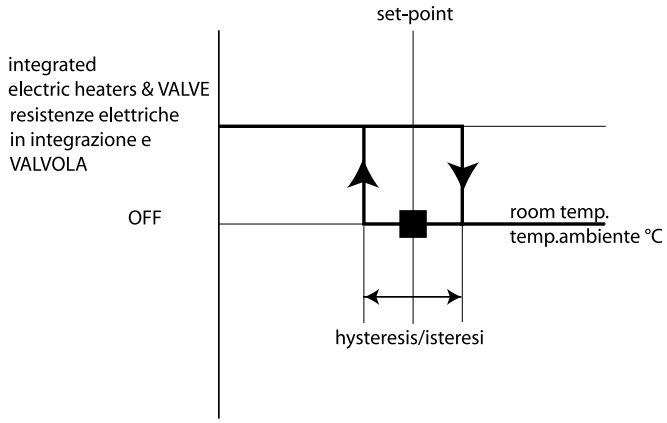


N.B.: There is a fixed hysteresis of1°C between temperatures of 15°C and 30°C to prevent constant fluctuations between A and B and between B and C.
For example, for rising temperatures, the switch from A to B takes place at 15.5°C whilst for falling temperatures, the switch from B to A takes place at 14.5°C. The same happens at the 30°C threshold (real thresholds of 29.5 and 30.5°C).

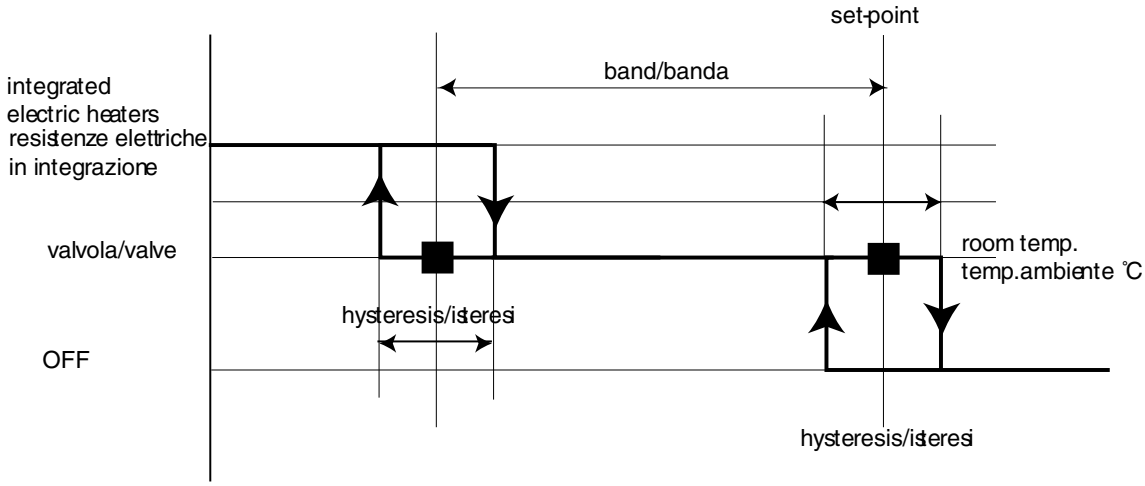
EXAMPLE A
The water temperature is too low to guarantee any transfer of *heat* from the water: the *electric heaters* alone are used (as if in regulation mode):



EXAMPLE B
Intermediate situation, *valve* and *electric heaters* are activated together with the temperature controller in **heating mode (winter).**



EXAMPLE C
The temperature of the water is sufficient to transfer *heat*, the *electric heaters* (more cost-intensive) are a second option: temperature control is the same as the example with *electric heaters* in integration.



6. FUNCTIONS

6.1 Fan operation on demand

The fan will only be operated in the manually selected speed, if the regulator has detected a request for Heating or Cooling. During dead zone the fan will be OFF. Through a *DIP switch* 5 you can select if the fan in *cooling mode* should run or not when the regulator is satisfied.

6.2 Hot Start

The *Hot Start* function prevents blowing a draught of cold air into the room during winter operation.
It means preheating of the exchanger (*finned battery*) before ventilation begins.
If a water sensor is present, ventilation will only start if the water sensor detects a temperature above 30 degrees. If this is not the case, it waits for consent from the sensor.
If there is no sensor, ventilation will always start after the 150 seconds delay time from *valve* opening.

NOTE: if *dip switch* 3=ON the *Hot Start* delay will be equal to zero (HS=0) .

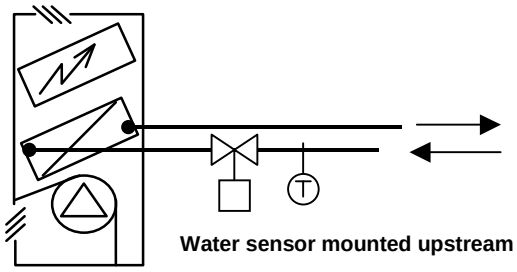
During *Hot Start* delay (controller by timer or water probe), the red *LED* (*heating*) will continue blinking.
After delay, when the fan starts, the red *LED* will remain fixed on.

This function is enabled only in *heating* mode

The *Hot Start* function controlled by "temperature" is available only for models with water probe for:

- 2-pipe installations with *electric heaters* set as integrated source (2° heating step)
- 4-pipe installations

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.



Water sensor mounted upstream

6.3 Periodic ventilation

Ventilation will be started for two (2) minutes at the end of the cycle to recycle air on the room air sensor if there has been no ventilation in the last twenty (20) minutes.

This prevents stratification of the air in the room, which will falsify the room temperature reading.

6.4 Frost protection

A heating *regulation algorithm* with a set point of 8 C° always remains active, ignoring water sensor consent and *operation mode*. It always comes on if the temperature drops below 8 C°, even if the controller is switched off.

This prevents equipment inside the room from freezing.

6.5 Post ventilation

The fan continues to run for 1 minute* after a heating source (heating *valve* or electric heater) is turned off.

This function prevents overheating inside the fan coil unit.
*NB: *Post-ventilation* always lasts 1 minute (it has the priority on all other *functions*). For example, when a change of mode occurs (from *Heat* to *Cool*), the fan does not stop but continues to work for the determined minute.

6.6 Anti valve sticking

This function avoids *valve* sticking after they've remained in the closed position for a long time. Each time a *valve* output has been operated, a timer will be started. When the timer reaches the pre-set value (approximately 1 week), the *valve* output will be forced open for 3 minutes.

6.7 Economy (only for 4200-1819)

The *economy* mode can be selected:

- Through an optional switch, on top of the controller,
- Through the *Economy* Function , available on terminals, clean contact or under voltage terminal (depending on models)

This function "shifts" the set point as described below:

- In *HEAT* (winter) mode: the set point is decreased by 6° C
- In *COOL* (summer) mode: the set point is increased by 8° C

This function will save energy, for instance, during the night or a holiday period.

This function is available on all models with product codes having suffix "E" or "N".

The Yellow LED will Blink when the ECO mode is operational

6.8 Window contact

Through a *window contact*, (voltage free) connected onto analogue input ST3 (*connection diagrams*), the controller can be switched in standby mode (*frost protection* mode active), when the window contact is closed. The purpose of this function is to prevent waste of energy when the window is opened by personnel.
This feature only applies to models which do not have the *remote Heating/Cooling* input.

The contact MUST be voltage free.
When the *window contact* is closed, *all LED's* will blink continuously. (Alarm indication)

To connect one *window contact* with several FC Basic controller inputs (ST3), you need to use an additional relay contact for each controller. A relay with a single SPST output contact or with multiple SPST contacts can be used.
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7. TECHNICAL FEATURES

7.1 Technical data

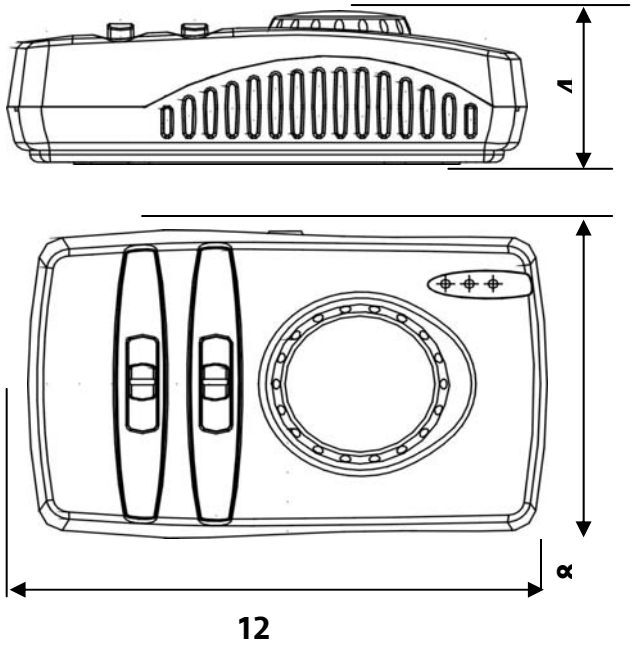
	Wall mounted version		
	Typical	Maximum	Minimum
Power supply voltage	230V~	253V~	207V~
Power supply frequency	50/60 Hz	52/63 Hz	47/57 Hz
Maximum absorbed power	12W	12W	12W
Insulation class	II	II	II
Protection grade	IP30	IP30	IP30
Operating temperature	25C°	60C°	0C°
Operating humidity (non-condensing)	30%	90%	10%
Storage temperature	55C°	85C°	-20C°
Storage humidity (non-condensing)	30%	90%	10%

- *Digital outputs* rating : 230V~ 5 (2)A
- *Analogue inputs* : 1 (+1) NTC probes;
- Assembly : wall mounted
- Housing: colour : Front : white
  Base plate ; grey
- *Connections* : screw terminals – SAURO connector for wires
  - max 2.5 mm² rigid cable;
  - max 1.5 mm² flexible cable.

***Attention: verify the power supply indicated on the device label.**

7.2 Dimensions

120x80x40 mm



7.3 Dichiarazione di conformità

The product complies with the following European Community Directives and Standards:

73/23/CEE and subsequent amendments, in compliance with the following standards:

- EN 60730-2-9

89/336/CEE and subsequent amendments, in compliance with the following standards:

- EN 60730-2-9
- Emissioni: EN 55014-1
- Immunità: EN 55014-2

8. 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.

9. 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.

10. DISCLAIMER