Zennio®

Passion for KNX innovation

'Home' Thermostat

Advanced Thermostatic Control Module

USER MANUAL

CONTENTS

1 INTRODUCTION

1.1 'HOME' THERMOSTAT FROM ZENNIO

A variety of Zennio products feature a functional module that implements a thermostatic control, which makes them capable of monitoring various indicators related to the climate control, as well as (depending on both the configuration and the temperature setpoint –or target temperature– required at a time), **sending the KNX bus the appropriate orders for the interfaces that interact with the climate systems**, so that the setpoint temperature can be reached.

The Zennio devices may include one of the following thermostat modules:

- **'Home' Thermostat**.

- **'Building' Thermostat**.

- **'Zennio' Thermostat**.

To verify which model ("Home", "Building" or "Zennio") has been incorporated into a specific version of the application program of a particular Zennio device, please refer to its user manual.

Also note that older versions of a certain application program may include a thermostat model different from that included in newer versions.

> **Note**: *hereafter, this manual will focus on the "Home" thermostat. For specific information about the other thermostat models, please refer to their corresponding user manuals, available at the http://www.zennio.com website.*

2 CONFIGURATION

2.1 TEMPERATURE

Prior to describing the thermostatic control process, it is important to clarify the following two basic concepts:

- **Setpoint Temperature**: this is the target temperature to be reached in the room, according to the user requirements. Although initially set by parameter, the setpoint temperature may vary at the users' request, depending on their needs each time.

- **Reference Temperature**: this is the actual ambient temperature registered in the room at a certain time, and is typically provided by an external KNX device with temperature measurement capabilities.

  It is also possible to make use of the combination of two different temperatures, which may be obtained by separate sensors (one of which can be the internal temperature sensor available on some of the Zennio devices that include the thermostat function). The Home thermostat offers the possibility of combining these two in the following proportions:

Proportion	Source 1	Source 2
1	75%	25%
2	50%	50%
3	25%	75%

Table 1. Combination of Reference Temperatures.

  Of course, it is necessary to group under the same address the "**[Tx] Temperature Source *i***" object together with the external object that provides the temperature measurements (or, if desired, with the object of the **internal temperature probe** of the device itself).

When configured, the Home thermostat can take care of **automatically switching between the two main climate modes (Cooling and Heating)** by comparing the setpoint and the reference temperatures. Should the setpoint be greater than the reference, it will switch to the Heating mode; on the contrary, it will switch to the Cooling mode if the setpoint is lower than the reference temperature.

2.2 WORKING MODES

To begin with, the integrator should configure which of the two main climate working modes (<u>Cooling</u>, <u>Heating</u> or <u>Both</u>) will be available, so that the thermostat can manage (by sending the corresponding orders to the bus) situations of hot weather, cool weather, or both, respectively. In addition, it is possible to set, by parameter, the **initial mode** of the thermostat (<u>Heating</u> or <u>Cooling</u>).

Moreover, provided that both modes have been enabled, switching between them can be done automatically (<u>this is only available on ZAS</u>), or depend on the state of a certain binary communication object. In **automatically switching**, the thermostat itself will switch the working mode when required after comparing the current setpoint with the reference temperature, which will determine the suitable working mode at each time.

- For an automatic **switch from Heating to Cooling**, an **upper band** needs to be defined. This is the band over the setpoint where the real temperature should be in order to remain in heating mode. When the real temperature rises over this band, the mode will switch from Heating to Cooling automatically.
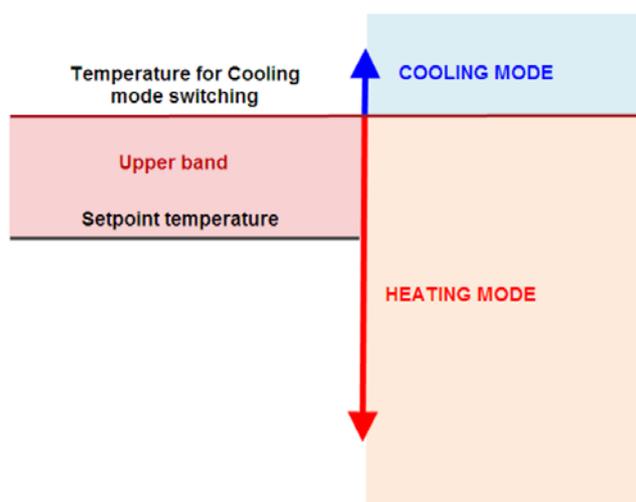

Figure 1. Working Modes: switching from Heating to Cooling mode.

- For an **automatic switch from Cooling to Heating**, a **lower band** needs to be defined. This is the band below the setpoint, where the real temperature should be in order to remain in cooling mode. When the real temperature drops below this band, the mode will switch from Cooling to Heating automatically.
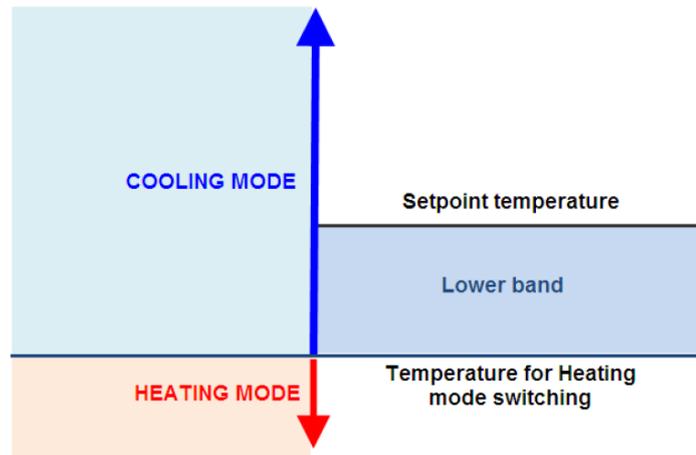
Figure 2. Working Modes: switching from Cooling to Heating mode.

The figure below shows a thermostat in Heating mode at the beginning. As the real temperature varies (and due to this variation), two automatic mode switches take place.
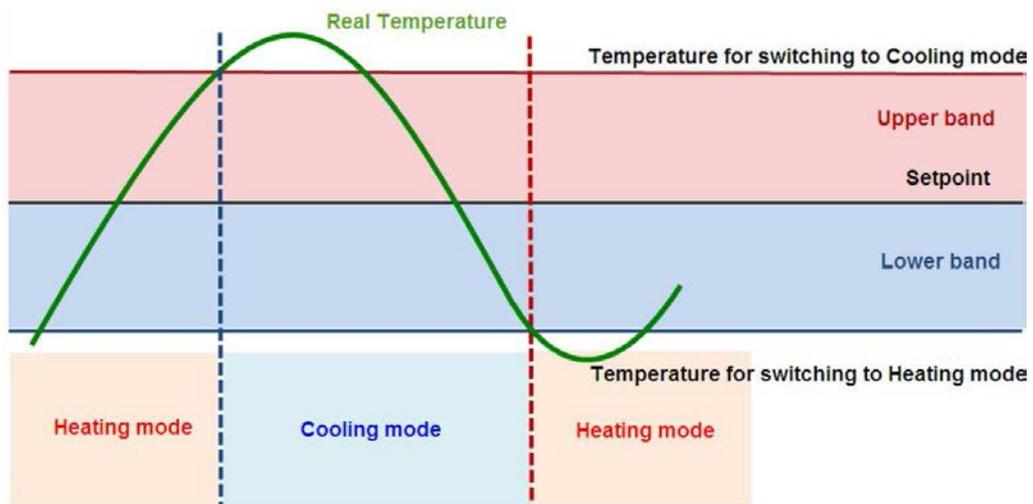

Figure 3. Example of automatic mode switching.

On the other hand, a **change of setpoint** results in a **change of the temperatures that define the upper and lower bands**. Thus, changing the setpoint value can cause an automatic mode switch, as shown in the next figure.
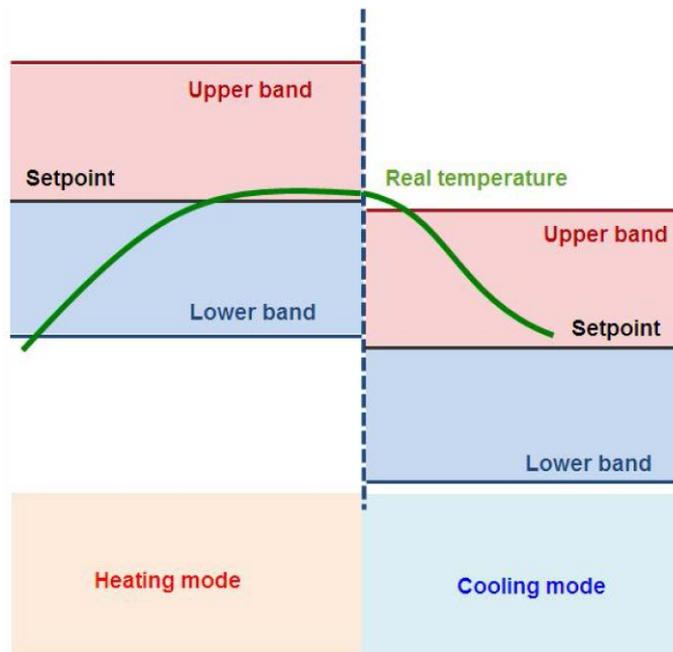
Figure 4. Automatic mode switching due to setpoint change.

2.3 CONTROL METHODS

Room thermostatic control consists in sending the proper orders to the climate system, so the room ambient temperature reaches a certain setpoint and then remains stable around that value.

Different algorithms are possible to perform such temperature control. Zennio thermostats let the integrator select one of the following two:

- **Two-point hysteresis control**.

- **Proportional-Integral control (PI)**.

2.3.1 TWO-POINT HYSTERESIS CONTROL

Similar to the climate control performed by conventional thermostats, this algorithm requires not only a **temperature setpoint**, but also **a pair of hysteresis values** (i.e., a lower and an upper limits), so a certain margin band is defined around the temperature setpoint, which prevents the thermostat from continuously switching from one mode to the other when the ambient temperature reaches the setpoint.

Example: *Two-Point Hysteresis.*

Let an initial temperature of 25ºC be parameterised, with an upper hysteresis of 1ºC under the Heating mode, and also assume that the ambient temperature is 19ºC, so the system will start heating the room. Once the temperature is 25ºC, it will continue heating until it becomes 26ºC, which is the upper limit of the hysteresis band. The climate system will then shut down, and will remain off until the ambient temperature is lower than 24ºC (not 25ºC), after which it will turn on again.

This algorithm throws a very particular temperature graph:
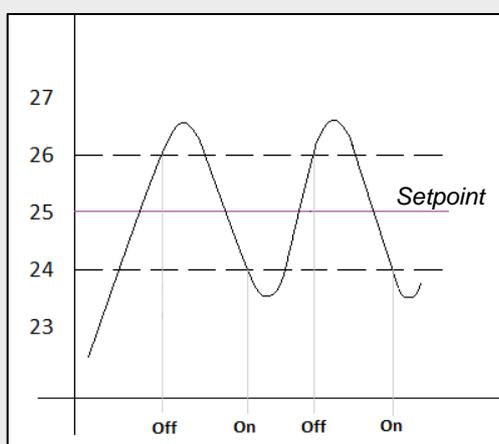
The main disadvantage of this algorithm, when compared to other advanced systems, is the permanent fluctuation around the setpoint temperature, which has a direct impact on the power consumption and on the comfort.
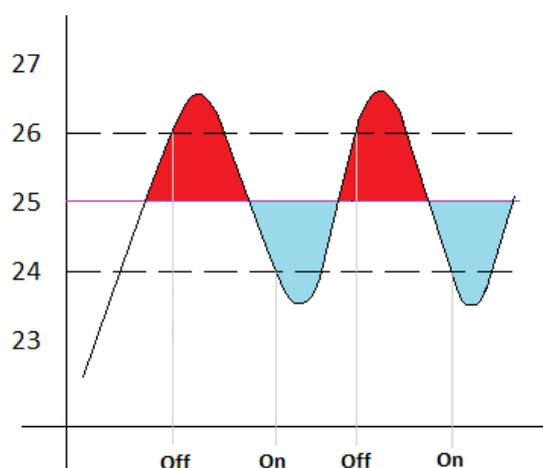
The Red-colour sections correspond to periods of unnecessary power consumption, and of lack of comfort due to excessive heat. On the contrary, the blue-colour sections indicate a lack of comfort due to insufficient heating.

2.3.2 PROPORTIONAL-INTEGRAL (PI)

It is a lineal control algorithm based not only on the difference between the setpoint and the reference temperature, but also on the history of the system. In addition, the control signals sent are not strict open/close orders, but intermediate orders, which notably reduce the temperature oscillation and the non-comfort sections of the previous algorithm, making the ambient temperature become progressively stable around the setpoint.
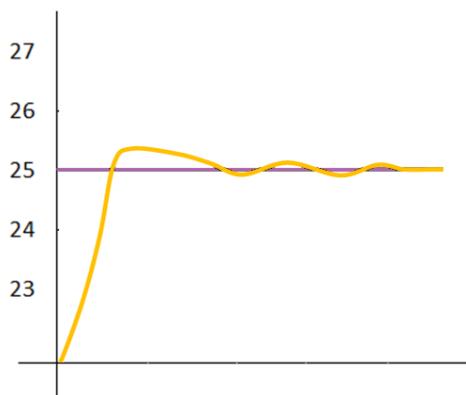

Figure 5. Proportional Integral.

This algorithm requires configuring three main parameters:

- **Proportional Constant (K)**: expressed in terms of degrees, estimates an error value proportional to the difference between the setpoint and the reference temperature.

- **Integral Time (T)**: expressed in minutes, this constant depends on the thermal inertia of the climate system, and makes it possible to adjust the approximation error depending on the elapsed time.

- **PI Cycle Time**: also expressed in minutes, this cycle time is taken into account for setting the temperature sampling frequency and therefore the update frequency of the control signal being sent.

Although the Zennio devices let expert users manually set custom values for the above parameters, generally it is preferable to make use of one of the pre-set options, which should fit the most common climate situations (see _ANNEX: Pre-set Values for the PI Control_).

Regarding the control signals of the PI mode, they can be expressed in two forms:

- **Continuous PI**: the control variable will throw **percentage values**, thus indicating *how much* the valve that regulates the gate (or grille) of the climate system should open. For instance, a value of 50% will indicate that the gate must remain half open. Of course, this method only applies to advanced systems, where the valves permit intermediate positioning.

- **PWM (Pulse Width Modulation)**: the control variable will be in this case **binary**, being therefore possible to control "on/off" valves, i.e., valves not permitting intermediate positions. Partial opening of the valve (for example: at 50%) is therefore emulated by successively opening/closing it (entirely) for brief time portions.

Example: *Pulse Width Modulation PI.*

Let a "continuous PI" thermostat control system determine a control variable of 25%, which would be interpreted by partial-positioning valves as an order to open the gate to 25% of their travel limit. The equivalent PWM variable for that would be a binary signal that remains at high level (value "1") for 25% of the configured PI cycle time, and at low level (value "0") during the remaining 75% of the cycle time. Therefore, an on/off valve will stay entirely open 25% of the time, and entirely closed 75% of the time.

|———— PI Cycle Time ————|

Average value (25%)
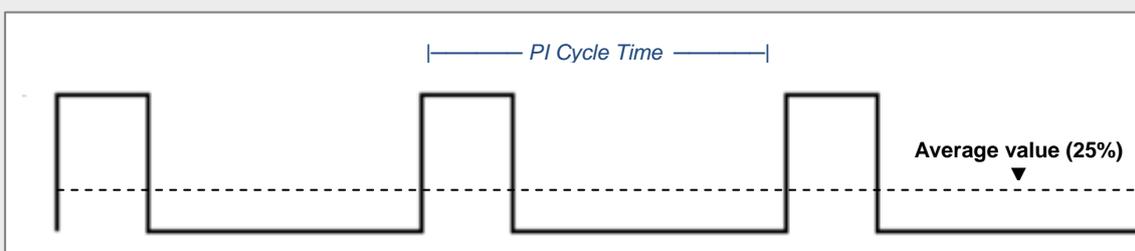
On the other hand, under situations of control signal saturation, during which the variable becomes 100% due to drastic differences between the setpoint and the reference temperature, a significant integral error will accumulate as time passes, so once the setpoint is reached, the system will still send a positive signal because of the influence of the system history in the PI algorithm. This will cause an excessive heat/cool supply, which will take some time to be compensated. To prevent these situations, the advanced configuration of the Home thermostat offers an option to **reset the accumulated error** as soon as the setpoint is reached after signal saturation.

The following figure shows the effect on the ambient temperature depending on whether the reset of the accumulated integral error is enabled or not.
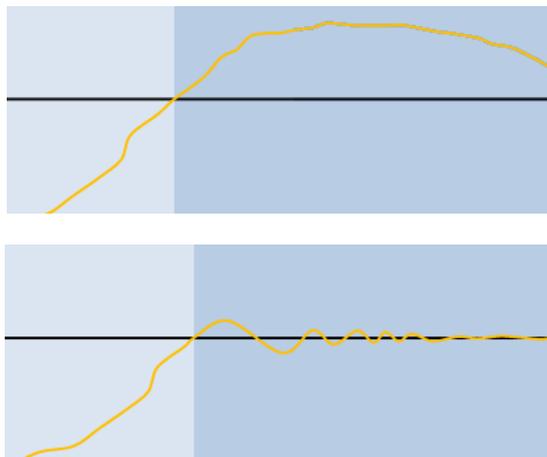

Figure 6. Effect of Resetting the Accumulated Integral Error after Signal Saturation

2.4 SPECIAL MODES

The Home thermostat (only on ZAS and Z38) can also distinguish different special working modes (**Comfort, Night, Stand-by**), so that when one of them is activated, a certain pre-set setpoint temperature is established, which helps to meet the user needs in different situations.

- In the case of **Z38**, enabling the special modes function brings the final user a specific screen to modify the **pre-set setpoint temperatures** of each mode. This screen is accessed from *Box 6* of pages configured as *Clima*, if configured to permit it.

- In the case of **ZAS**, the **Enable Special Modes** option entails the appearance of **communication objects** to set the pre-set temperature of each special mode, for cooling and for heating. These objects are:

  - ➤ Comfort Setpoint Temperatura (cooling)
  - ➤ Comfort Setpoint Temperature (heating)
  - ➤ Night Setpoint Temperature (cooling)
  - ➤ Night Setpoint Temperature (heating)
  - ➤ Stand-by Setpoint Temperature (cooling)
  - ➤ Stand-by Setpoint Temperature (heating)

When the thermostat is ON, the current special mode can be switched by sending a "1" to the specific binary object corresponding to the desired mode, which will make the thermostat adopt the pre-set setpoint of such special mode as the current setpoint.

Nevertheless, when the thermostat is OFF and a special mode is established, the thermostat behaviour will depend on the **Reaction of Clima in OFF when receiving a Special Mode** (see sections 3.1 y 3.2).

2.5 COOLING / HEATING PROTECTION

Protection from overheating or freezing is destined to activate the appropriate air-conditioning elements to avoid **"extreme" temperatures**.

This protection, both against overheating or against freezing, activates **when the thermostat turns off**, although it is possible to completely disable this function in parameters (ETS), as well as to set the limit temperatures, i.e., the minimum or maximum allowable temperatures prior to the activation of the appropriate climate system. Nevertheless, to prevent successive activations and deactivations, **a hysteresis of 1ºC** (upwards in the case of overheating protection, and downwards in the case of freezing protection) has been implemented.

Although the device will not show evidence of the activation of this protection, the **thermostatic control variable** will acquire the most demanding value ("1" for a one-bit variable, and "100%" for a one-byte variable), so the air-conditioning system responds as soon as possible.

> **Example**: *protection against overheating and freezing:*
>
> - *Upper Limit: 35 ºC*
> - *Lower Limit: 7 ºC*
> - *Control Method: CONTINUOUS PI*
>
> *At a given moment, with the thermostat in the OFF status, the reference temperature results to be 6.9 ºC. Because of that, the value of the thermostatic control variable is forced to 100%. Due to the air-conditioning system action, the temperature begins to increase. Once the temperature is higher than 8 ºC (1 ºC of hysteresis), the value of the variable returns to 0%.*

2.6 ADDITIONAL COOLING / HEATING

The Home thermostat from Zennio is capable of **controlling secondary heat/cool sources** (air-conditioning devices, heat pumps, etc.), in case they are available. This way, it is possible to perform an even more effective thermostatic control by combining multiple climate systems for the same purpose, which will report a higher comfort level.

As an example of this function, think of a room where the primary climate system is a radiant floor system (which is characterised for a high thermal inertia and for a moderately slow response after setpoint changes) and a split air conditioner as a support system, being the latter capable of a more agile response when a setpoint change occurs.

Configuring the Additional Cooling / Heating function, it is necessary to define a certain **temperature range** (or band) that will determine when the auxiliary system should come into operation. Once defined, the process is as follows:

- **Cooling Mode**: as soon as the reference temperature is found to be **greater or equal** than T_1 (being T_1 equal to the setpoint temperature plus the Additional Cool band), the auxiliary cool system will come into operation to provide a more effective cooling. Then it will switch off once the reference temperature is lower or equal than $T_1 - 0.5^oC$.

---

Example: *Additional Cooling.*

Suppose a setpoint temperature of 23ºC and an Additional Cool band of 2ºC. In such case, the additional cooling will interrupt at 24.5ºC.
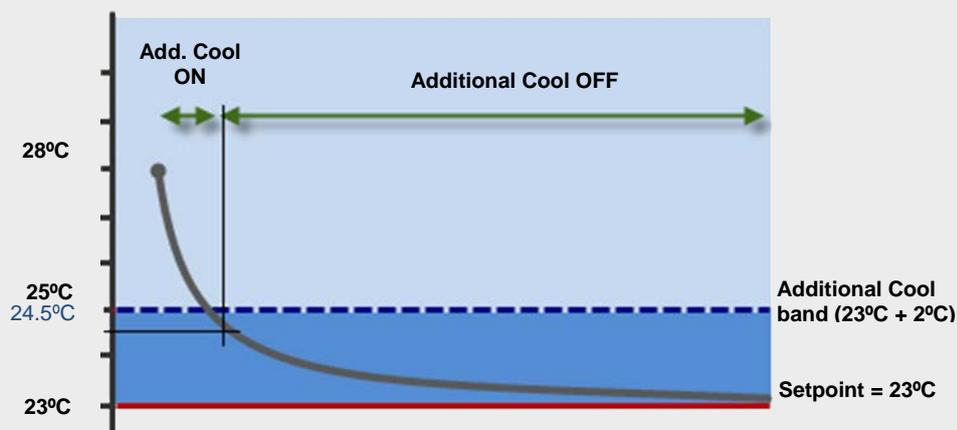
- **Heating Mode**: as soon as the reference temperature is found to be **lower or equal** than T_2 (being T_2 the setpoint temperature minus the Additional Heat band), the auxiliary heat system will come into operation to provide a more effective heating. Then it will switch off once the reference temperature is greater or equal than T_2 + 0.5ºC.

Example: *Additional Heating.*

Suppose a setpoint of 23ºC and an Additional Heat band of 2ºC. In such case, the additional heating will interrupt at 21.5ºC.
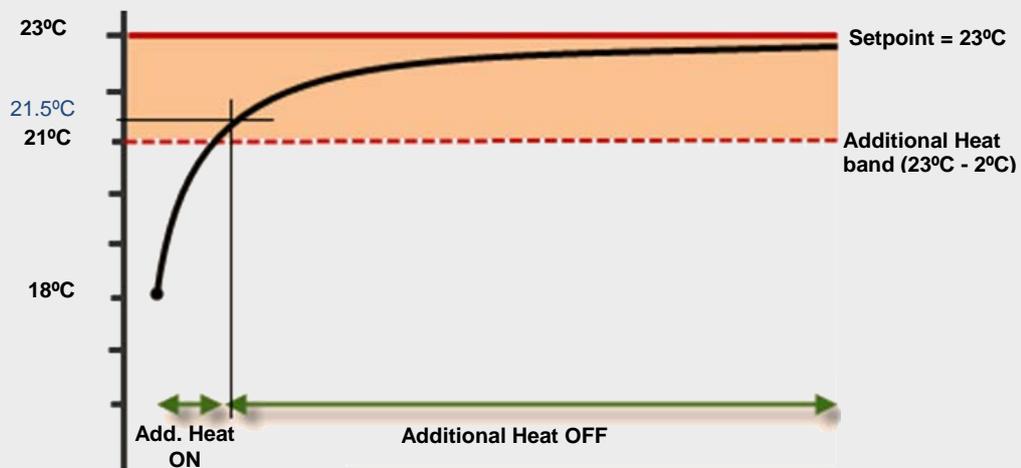
2.7 EXTERNAL CLIMATE CONTROL

The **climate parameters** of certain actuators can be established from **external control devices**, e.g., panels Z38 and ZAS.

The objects of Z38 involved in sending the state of the climate control are:

- **[Clima X]: Sending ON/OFF**
- **[Clima X]: Sending Mode**
- **[Clima X]: Sending Setpoint Temperature**

On the other hand, ZAS sends the state through the following objects:

- **Thermostat – ON/OFF Status**

- **Cooling/Heating**

- **Setpoint Temperature Status**

In the same way, both Z38 and ZAS can receive these values externally, for example from another touch panel. This is useful in the case of a **centralised air-conditioning** system for all zones in a building. For this purpose, it is necessary to link the above-mentioned sending communication objects of the main touch panel with the reception objects in the destination touch panels, which in the case of Z38 are:

- **[Clima X]: Receiving ON/OFF**

- **[Clima X]: Receiving Mode**

- **[Clima X]: Receiving Setpoint Temperature**

While in the case of ZAS are (note that the mode object is the same for the reception and for the sending):

- **Thermostat ON/OFF**

- **Cooling/Heating**

- **Setpoint Temperature**

3 ETS PARAMETERISATION

This section describes the ETS configuration of the Home thermostat on the different devices that incorporate it.

3.1 Z38

To configure the thermostat function in the Z38 touch panel, it is necessary to enable one **Clima** page in the "Pages" tab.

3.1.1 "CLIMA" TAB

Once the Clima page is available, its corresponding tab permits the configuration of the **boxes** of such page, in order to configure which of them will be available for the user:
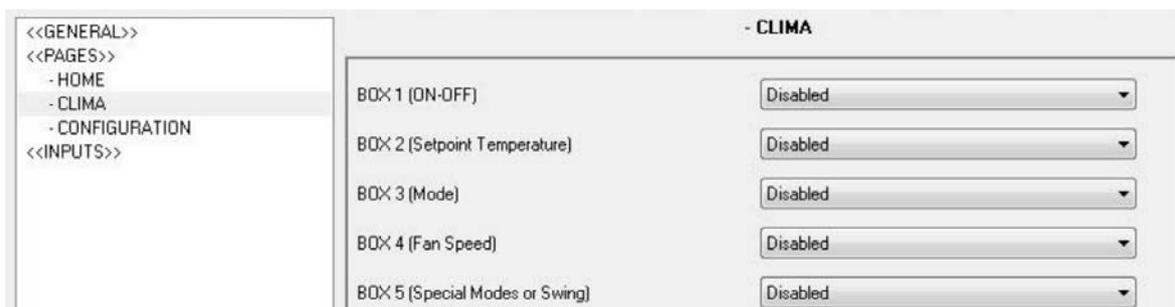

Figure 7. Clima tab.

- **BOX 1 (ON-OFF)**,

- **BOX 2 (Setpoint Temperature)**,

- **BOX 3 (Mode)**,

- **BOX 4 (Fan Speed)**,

- **BOX 5 (Special Modes or Swing)**.

All of these parameters as well as the involved objects are detailed in the specific **user manual** of Z38.

Apart from the configuration of the boxes, it is also possible to enable the **thermostat** itself, as shown in the following figure:
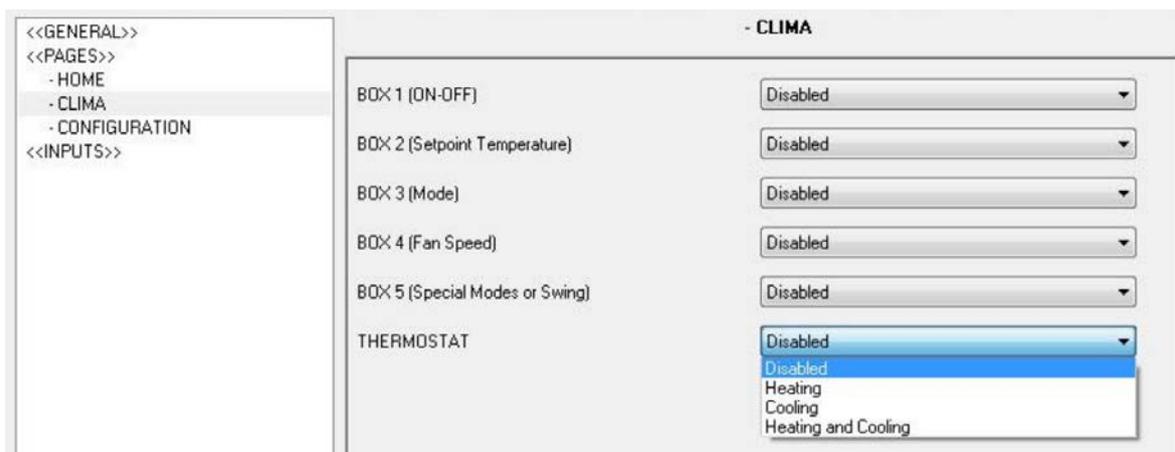
Figure 8. Enabling the thermostat in Z38.

The thermostat type must be set according to the intended purpose: "Heating", "Cooling" or "Heating and Cooling". For both Heating and Cooling, the following parameters appear:

- **Freezing Protection** / **Overheating Protection**: they set the protection limit temperature, respectively for Cooling and Heating. The available range is [0, 15] for Cooling and [30, 45] for Heating.See section 2.5

- **Control Method**: sets the control algorithm to be applied. The options are "2-Point Control" and "PI Control" (see sections 2.3.1 and 2.3.2).

  ➢ 2-Point Control.

Figure 9. 2-Point Control.

The control variable will be in this case a one-bit object, "**[Clima X] Control Variable (Heat)**" or "**[Clima X] Control Variable (Cool)**", which will send the value "1" when the thermostat considers that the room needs to be conditioned (heat/cool) and the value "0" while the system can remain off.

The configurable parameters are:

- **Lower Hysteresis**: defines the value of the lower hysteresis (between 1 and 50 tenths of a degree), i.e., the lower limit of the margin band around the setpoint temperature.

- **Upper Hysteresis**: sets the value of the upper hysteresis (between 1 and 50 tenths of a degree), i.e., the upper limit of the margin band around the setpoint temperature.

➢ PI Control.

Figure 10. PI Control

The control variable ("**[Clima X] Control Variable (Heat)**" or "**[Clima X] Control Variable (Cool)**") in this case may be either a one-byte or a one-bit object, depending on the configuration of the "**Control Type**" parameter, as explained below.

The configurable parameters are:

- **Control Type**: sets whether the climate system valve should be controlled through precise positioning ("Continuous (1 byte)") or through on/off orders ("PWM (1 bit)").

  In the first case, the control variable will be a one-byte object and will reflect, as a percentage, the opening level required in the valve (100% = entirely open; 0% = entirely closed).

  In the second case, on the contrary, the variable will be a one-bit object that will successively commute between "1" and "0" depending on the cycle time ("**PI Cycle**") and according to the aforementioned opening level, which will determine the proportion between the time the object has a value of "1" and the time it has a value of "0".

  Under a **PWM control**, the thermostat status indicator (ON) within the Clima page will show the asterisk symbol (*) while the control variable is equal to "1", and will not when this variable is again equal to "0".

Figure 11. Touch Panel Z38: Indicator of the PI-PWM control variable.

- **PI Cycle**: sets every how much time (1 to 250 minutes) the required opening level of the valve (or, in the case of the PWM modulation, the proportion between "1" and "0") will be re-calculated.

- **Control Parameters**: defines the desired values for the K and T parameters for the PI algorithm. It is highly encouraged to make use of the pre-set values ("Warm Water", "Floor Heating", "Electric Heating", "Blow Convector" or "A/C Split"; see *ANNEX: Pre-set Values for the PI Control*) however it is possible to specify custom values ("Advanced"). Selecting the latter brings the following parameters:

  o **Proportional Band**: defines the value for K, between 1ºC and 15ºC.
  o **Integral Time**: sets a value for T, between 5 and 255 minutes.

- **Additional Heating / Cooling**: enables or disables the Additional Heating function (see section 2.6). When enabled, the "**[Clima X] Additional Heat**" or "**[Clima X] Additional Cooling**" one-bit object will be available, as well as the parameter **Additional Heating/Cooling Band** (which takes values between 5 and 100 tenths of a degree).

The following figure illustrates one configuration where both heating and cooling are required. For the Heating mode, a continuous PI control has been selected, while for the Cooling mode, a two-point hysteresis control is required. Protection is enabled for both.
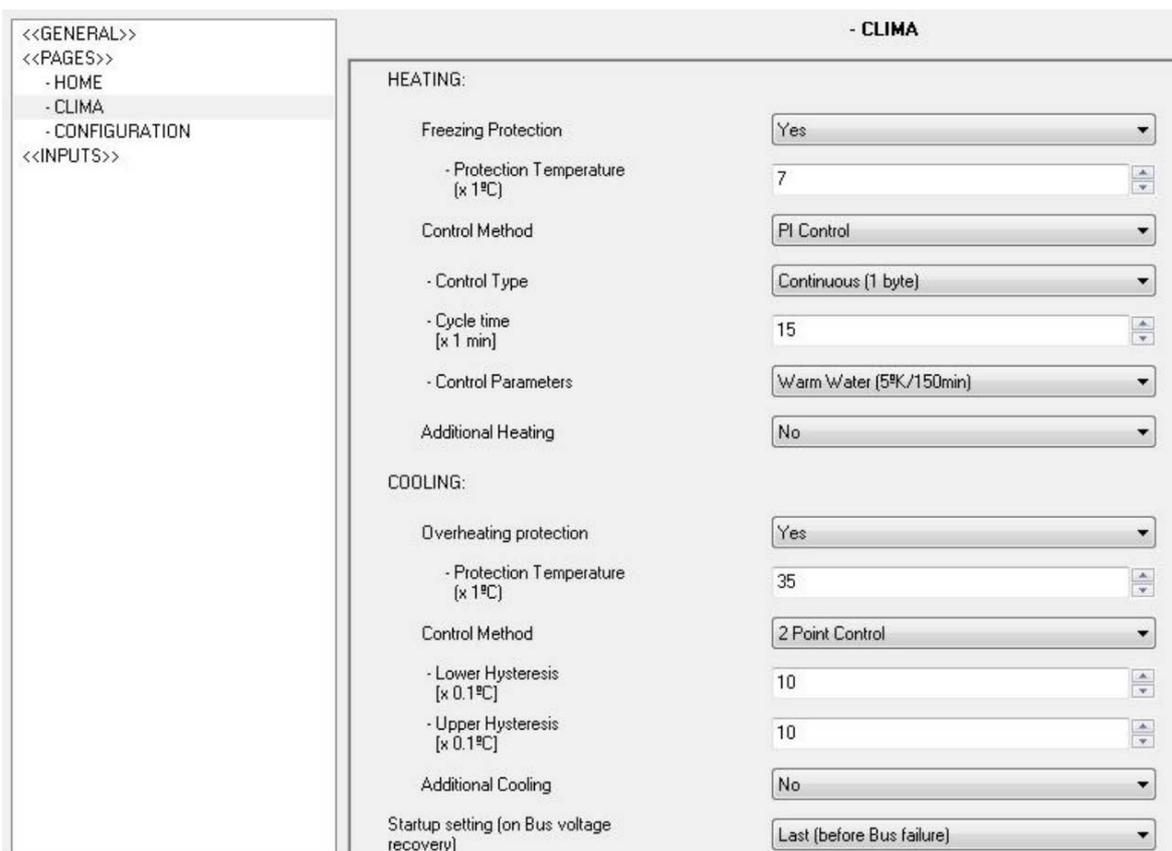
Figure 12. Z38 Thermostat. Heating and Cooling.

On the other hand, the Special Modes can be activated by the user by means of the **BOX 5** of the Clima page. The parameters involved in these modes, as shown in Figure 15, show up upon the assignment of this function (Special Modes or Swing) to that box.

Thus, after selecting "Special Modes [Comfort, Night and Stand-by]", the **Reaction of Clima in OFF when receiving a Special Mode** parameter appears, which sets what action should be taken when a special mode activation order is received while the thermostat is off:
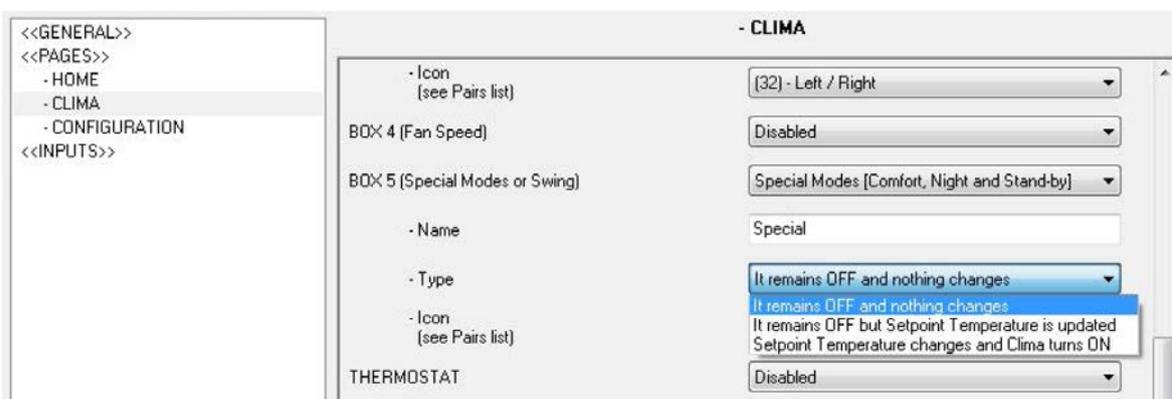

Figure 13. Special modes in Z38.

- "It remains OFF and nothing changes"

- "It remains OFF but setpoint temperature is updated"

- "Setpoint temperature changes and Clima turns ON"

3.1.2 THERMOSTAT CONTROL FROM THE 'HOME' PAGE

Users can control the state of the thermostat not only from the Clima page, but also from the **Home page** of the Z38 touch panel. The boxes of such page can therefore *emulate* those of the specific Clima pages that may have been configured.

Once at least one Clima page has been enabled and configured, is is necessary to **assign any of the boxes in the Home page** the climate control function, and after that, the particular **control type** desired:

- **ON/OFF**, to control the thermostat switch-on and switch-off.

- **Temperature**, to control the setpoint temperatura.

- **Mode**, to switch the Cool/Heat mode.

- **Fan**, to control the fan level.

- **Swing**, to control the swing function of the slats.

- **Special Mode (Comfort / Night / Stand-by)**, to activate one of the special modes.

Finally, it is necessary to indicate which of the Clima pages will control this box (through parameter "**Linked to**"), and the desired icon.

Figure 14. Thermostat control from the Home page.

3.2   ZAS

In ZAS, the thermostat is enabled in the MENU tab, as shown in Figure 15. This brings two new tabs to the tab tree on the left: "**Thermostat (Config.)**" and "**Thermostat (Labels)**".
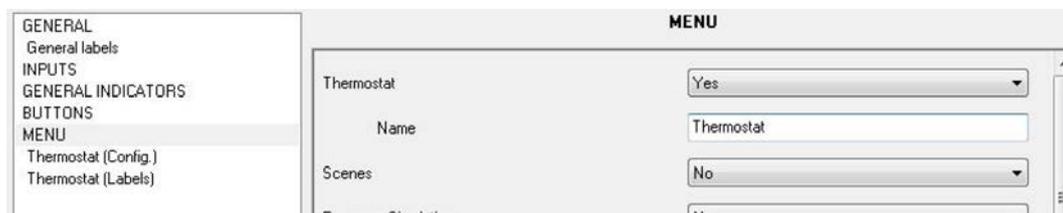

Figure 15. Enabling the Thermostat.

3.2.1 "THERMOSTAT (CONFIG.)" TAB

In the **Thermostat (Config.)** tab, the following options can be configured:

- **Thermostat Function**: defines the main working modes that will be available: "Disabled", "Heating", "Cooling", or "Heating and Cooling"). Depending on the selection, one or two secondary tabs (one per mode: Heating and Cooling) will show in the tab list on the left.

  In case of selecting any of the modes, additional parameters will be displayed:

  ➢ **Heating/Cooling Automatic Switching**: grants or not the thermostat the responsibility of automatically switching from one mode to the other one (Heating / Cooling) by comparing the reference and setpoint temperatures. The available options are:

    - "Always enabled": the mode switching is always automatic.

      o **Upper band [x0.1ºC] Heating -> Cooling**: sets a margin over the setpoint, so when the reference temperature exceeds it the mode switches automatically from Heating to Cooling. Valid values are 0.5 to 4ºC.

      o **Lower band [x0.1ºC] Cooling -> Heating**: sets a margin below the setpoint, so when the reference temperature is lower the mode switches automatically from Cooling to Heating. Valid values are 0.5 to 4ºC.

    - "Always disabled": mode switching is always manual.

- "Enable using 1 bit object": incorporates a one-bit object named "**Heating/Cooling automatic switching**", which enables automatic mode switching when the value "1" is received, and disables it when the value "0" is received (so only manual switch remains available). This option also requires configuring the **upper pand** and the **lower band**.

  With independence of the configuration of this parameter, the current mode may always be manually switched through the "**Cool/Heat**" communication object ("0" will switch to "Cooling", while "1" will switch to "Heating").

- **Enable Special Modes [Comfort, Night, Standby]**: by activating this function, the special modes Comfort, Night and Standby will be available (and so will be the objects that trigger each of them), being also possible to configure the **Special Mode Activation means...** parameter appears, which sets what action should be taken when a special mode activation order is received, even if the thermostat is off:

  - "It remains OFF and nothing changes".

  - "It remains OFF but Setpoint temperature is updated".

  - "Setpoint temperature changes and clima turns ON".

- **Startup Setting (on Bus Voltage Recovery):** sets the status of the thermostat after a device initialisation (either a download or a bus power failure): "Last", "ON", "OFF"). After a download, "Last" is equivalent to "Off".

- **Reference Temperature**: determines the source of the reference temperature. This may be the value of a sole communication object, or a combination (in a configurable proportion) of the values of two communication objects. These objects should in any case be linked to those providing the temperature measurements (e.g.: the object of the internal probe). See 2.1.

- **Sending Statuses on Bus Voltage Recovery**: sets whether the device should send the KNX bus the thermostat state objects after the start-up. Sending their updated value is also possible under a certain delay (2-255 seconds), defined through "**Sending Delay [x 1sec]**".

Figure 16. Sending the Status

3.2.2 "THERMOSTAT (LABELS)" TAB

Figure 17. "Thermostat (Labels)" tab

From this screen, the integrator can enable each of the thermostat controls and configure the labels (texts) that will be shown on the screen (within the thermostat menu). The available controls and the customisable labels are:

- **Temperature**:
  - Name:
- **On-Off**.
  - Name.
- **Setpoint**:
  - Name.
- **Mode**:
  - Name.
  - Cool.
  - Heat.
  - Auto.
- **Special modes**:
  - Name.
  - Comfort.
  - Night.
  - Standby.

> ➢ Active.

> ➢ Config.

3.2.3 "HEATING" AND "COOLING" TABS

All parameters contained in these tabs are entirely analogous to some of those already explained for Z38 (see section 3.1.1).

3.3   IRSC ZONE

Compared to ZAS or Z38, IRSC Zone offers a very basic thermostat function. This is due to the fact that the zones (or rooms) that will be controlled by IRSC Zone are supposed to have their own user interfaces (such a touch panel) with their own thermostats. Therefore, IRSC Zone does not need to deal with special modes or other advanced functions – only with the ON/OFF state of those thermostats and their reference and setpoint temperatures.

Although this user manual covers important concepts for the configuration of IRSC Zone (the Cool / Heat modes and the the 2-Point / PI control methods), the description of the few parameters that need to be configured in the thermostat of IRSC Zone can be found in the specific user manual of such application program.

ANNEX: PRE-SET VALUES FOR THE PI CONTROL

The tables below show the different profiles for the PI Control that have been pre-set in the Home thermostat from Zennio, and the corresponding values of the K and T parameters.

Profile	K	T (min)
Warm Water	5	150
Floor Heating	5	240
Electric Heating	4	100
Blow Convector	4	90
A/C Split	4	90

Table 2. PI Control Profiles for the Heating Mode

Profile	K	T (min)
Cooling Ceiling	5	240
Blow Convector	4	90
A/C Split	4	90

Table 3. PI Control Profiles for the Cooling Mode

These values have been obtained empirically, and are therefore optimised for the most common climate control contexts. Making use of them is highly encouraged, leaving the manual configuration of these values for very specific situations and for specialists with experience in advanced climate control.