ONLINE TRAINING

Topic I Visualization & Control

Touch Panel Z38i: Clima Page and Thermostatic Control

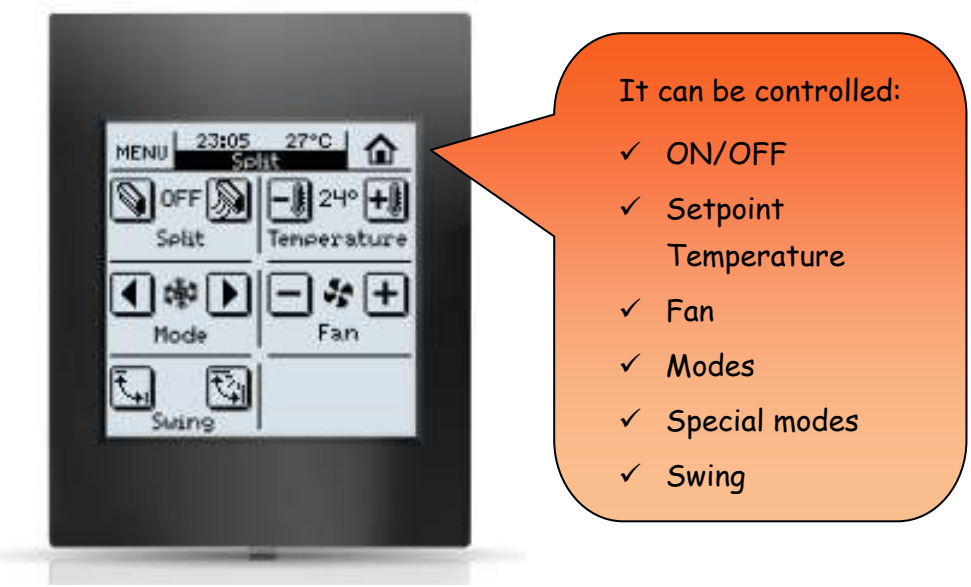
Edition 1

2010

Introduction

The touch screen relies on specific pages specially designed for controlling air-conditioning systems such as splits, fan coils or radiant floor.

In Zennio we have unified this page in the Touch Panel Z38i for controlling every type of air-conditioning system without using different pages according to the system we want to install.



The touch panel allows configuring up to 4 specific Clima pages and every one of them allows enable a thermostat that can be controlled with two different methods:

- Proportional Integral Control
- 2 Points with Hysteresis

For the thermostatic control we can use the temperature probe of the Z38i, external probes coming for example from one QUAD, and we can also mix the measures of both the internal temperature and one external temperature in the desired proportion

Thermostatic Control

In this section we are going to learn what the available methods for thermostatic control in the Z38i involve.

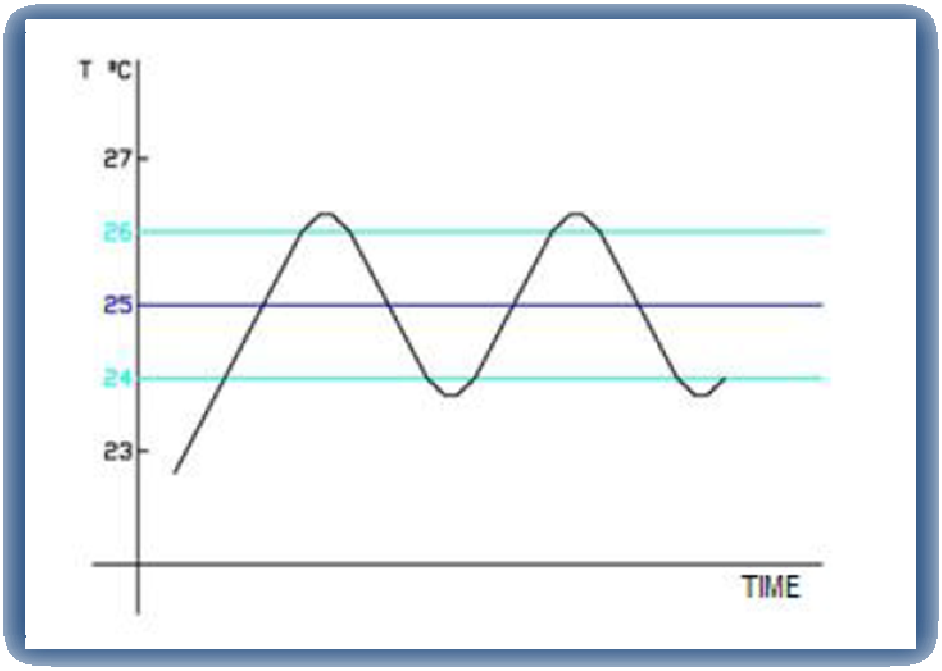
2 Points with Hysteresis

The 2-points hysteresis control system is less efficient than other control systems that are more advanced. Nevertheless it may be very interesting for some installations. It is the control implemented in conventional thermostats.

In this control system we have to establish a **setpoint temperature**, and **two hysteresis**: **lower** and **upper** hysteresis. The purpose of the hysteresis is that the system is not continuously switching around a setpoint temperature in brief time periods.

Let's see how this method works using an example:

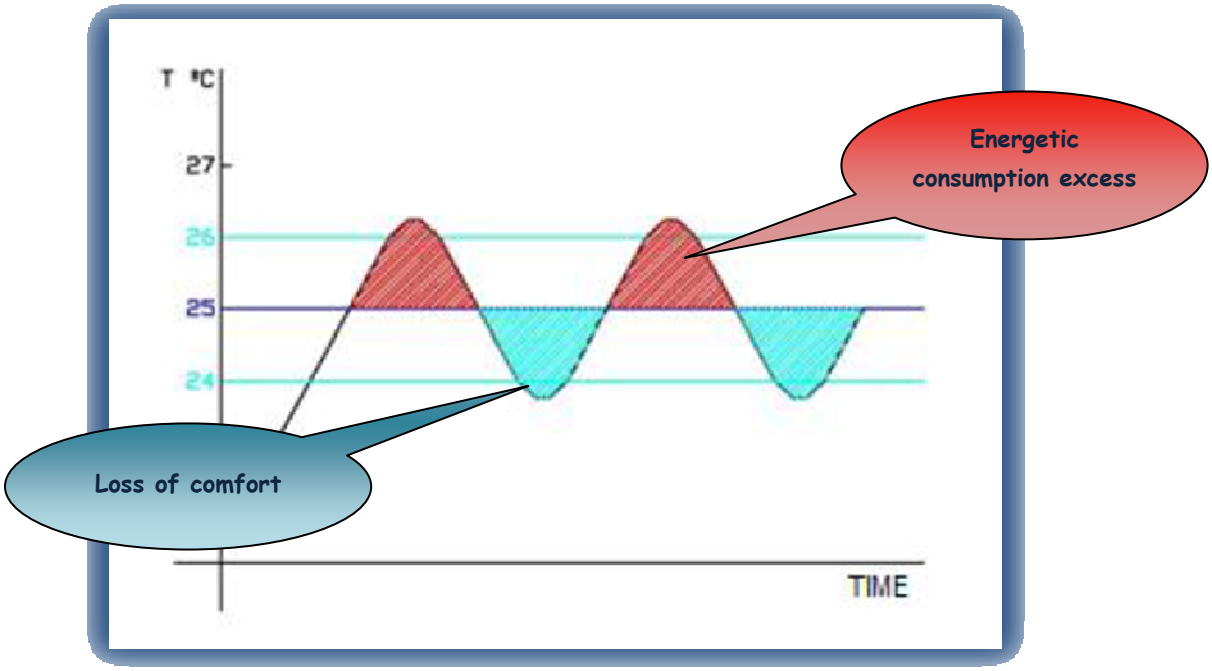
A setpoint temperature equal to 25 ºC is established in mode "heating". Both the lower and the upper hysteresis are configured with the value 1ºC.



The initial room temperature is 19 ºC. When the temperature reaches 25 ºC, the system will go on heating, until the temperature reaches 26 ºC.

Once the upper hysteresis is reached, the system is switched off. Since the system is off, the temperature begins to decrease, but the system will not be switched on at 25 ºC (setpoint temperature): it will do it when the lower hysteresis is reached. This is when the room temperature is equal to 24 ºC

The problem of this control type is the continuous oscillation that has direct influences in the energetic consumption and comfort. The red zone indicates an excess in the energetic consumption, because the room temperature is upper than the setpoint temperature.



The blue zone indicates a lack of comfort because the room temperature is lower than the setpoint temperature.

Moreover and unlike we could think at first, the blue zone or comfort lack does not compensate the excess energetic consumption of the red zone.

Proportional Integral Control

The other thermostatic control that can be found in the heating systems is the **Proportional Integral (PI) control**.

PI is a system of integral calculation that depends on two values:

> K: Proportional constant, in Kelvin grades (ºK), that allows estimating one error value proportional to the difference between the setpoint temperature and the room temperature.

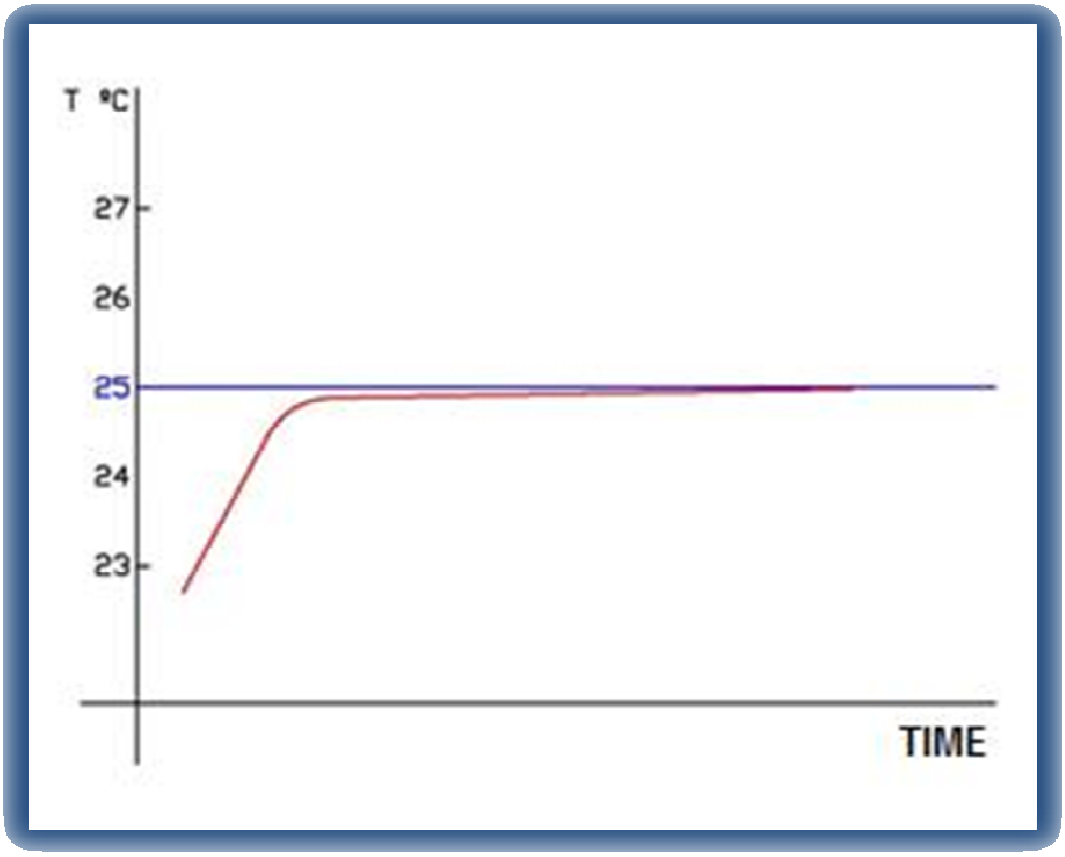
T: Integration time, in minutes (min) that depends on the thermal lag of the air-conditioning system that allows adjusting the approximation error in connection with the passed time.

When configuring this type of control in the Touch Panel, we can choose, from a pull-down menu, between a series of couples composed by a K value and a T value specific for every type of system. However the Z38i offers us the option of assigning other couple of values.

The PI control system has two variants:

- **PI Continuous**
- **PI PWM** (Pulse Width Modulation)

First, we have the **PI–Continuous** control which is carried out by means of one 1 byte variable. This 1-byte variable keeps a percentage that indicates the opening percentage that the valve has to acquire in a certain time cycle. For example, a value of 50% for the PI–Continuous is indicating the valve to open in half.

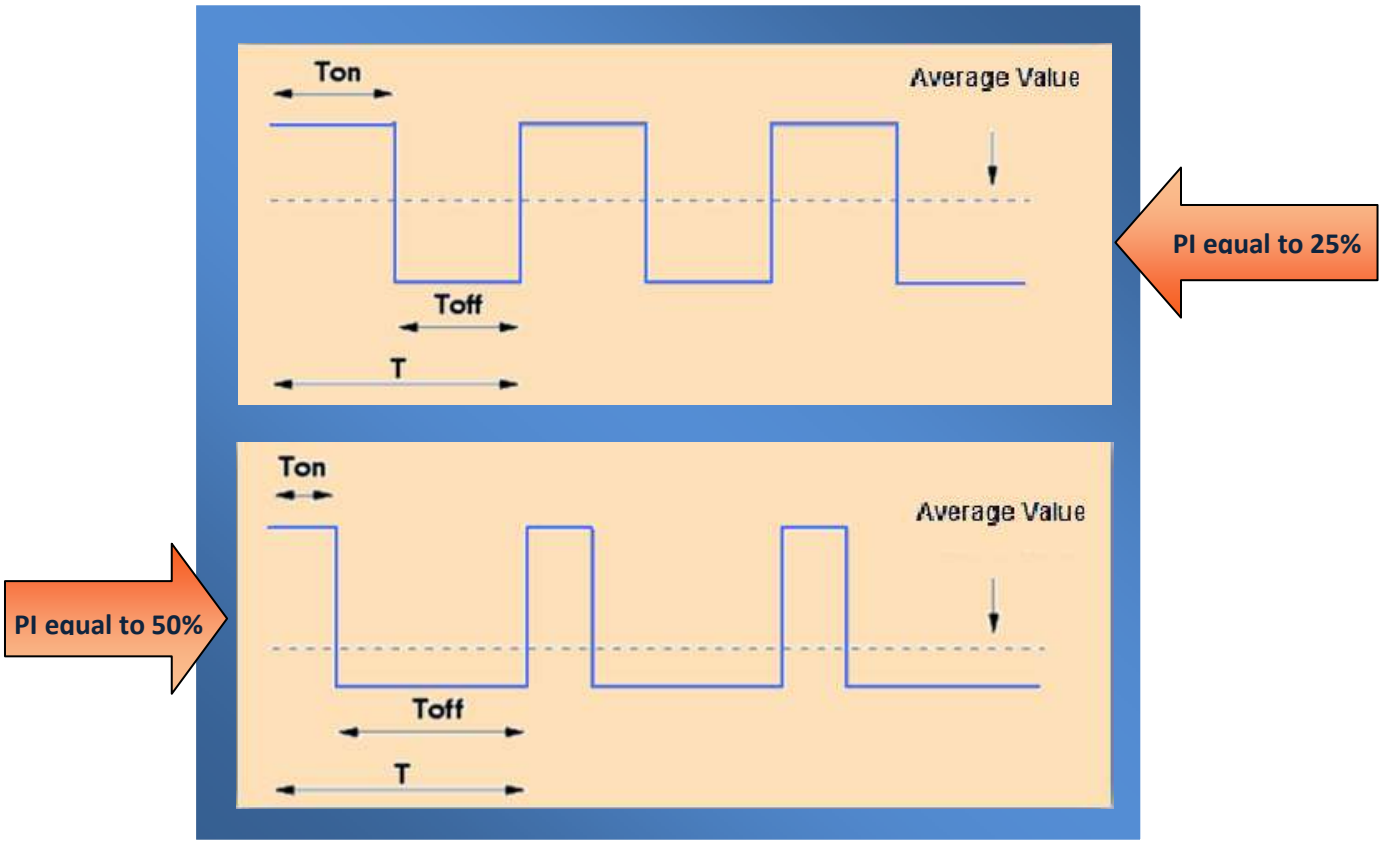


The inconvenient for this type of control is that the systems need more sophisticated valves than the all–nothing valves, making difficult their control and increasing the installation cost.

For this reason the PI PWM system comes up, since a method of traducing the percentage value used in the PI Continuous to 0's and 1's is applying a Pulse Width Modulation (PWM) to the PI continuous percentage. This way we obtain "0" and "1" that will remain during certain period of time for controlling all-nothing valves simulating the same effect that the PI Continuous system.

Example: PI Continuous Control and PI PWM Control.

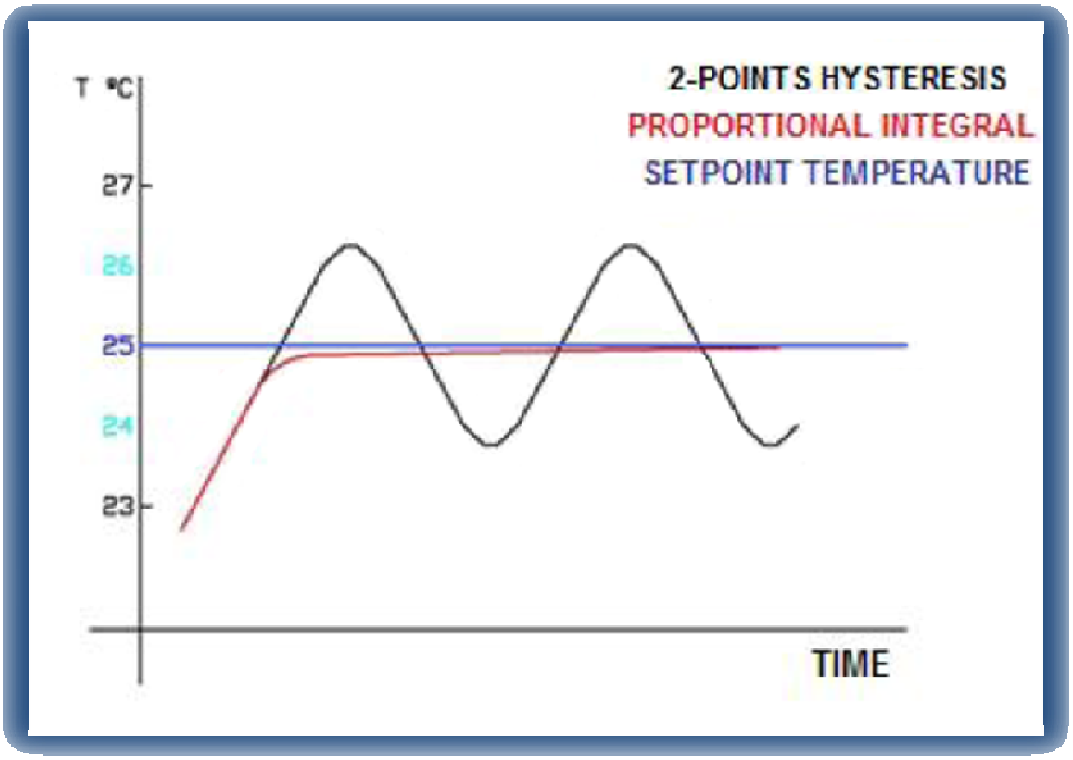
When the PI Continuous value is equal to 50% and we apply the pulse width modulation we obtain that during the half of the cycle time (T_{ON}) the PWM variable is equal to "1" and during the other half of the cycle time (T_{OFF}) the PWM variable is equal to "0".



When the value of PI-Continuous is equal to 50%, the modulation PWM maintains a pulse equal to "1" during ¼ of the time cycle, and a pulse equal to "0" during ¾ of the time-cycle.

Comparing the control methods

The following figure shows the curves of the different thermostatic control methods that we have previously seen. When looking at the figure we can conclude that the best method is the Proportional Integral Control since it remains closer to the setpoint temperature.

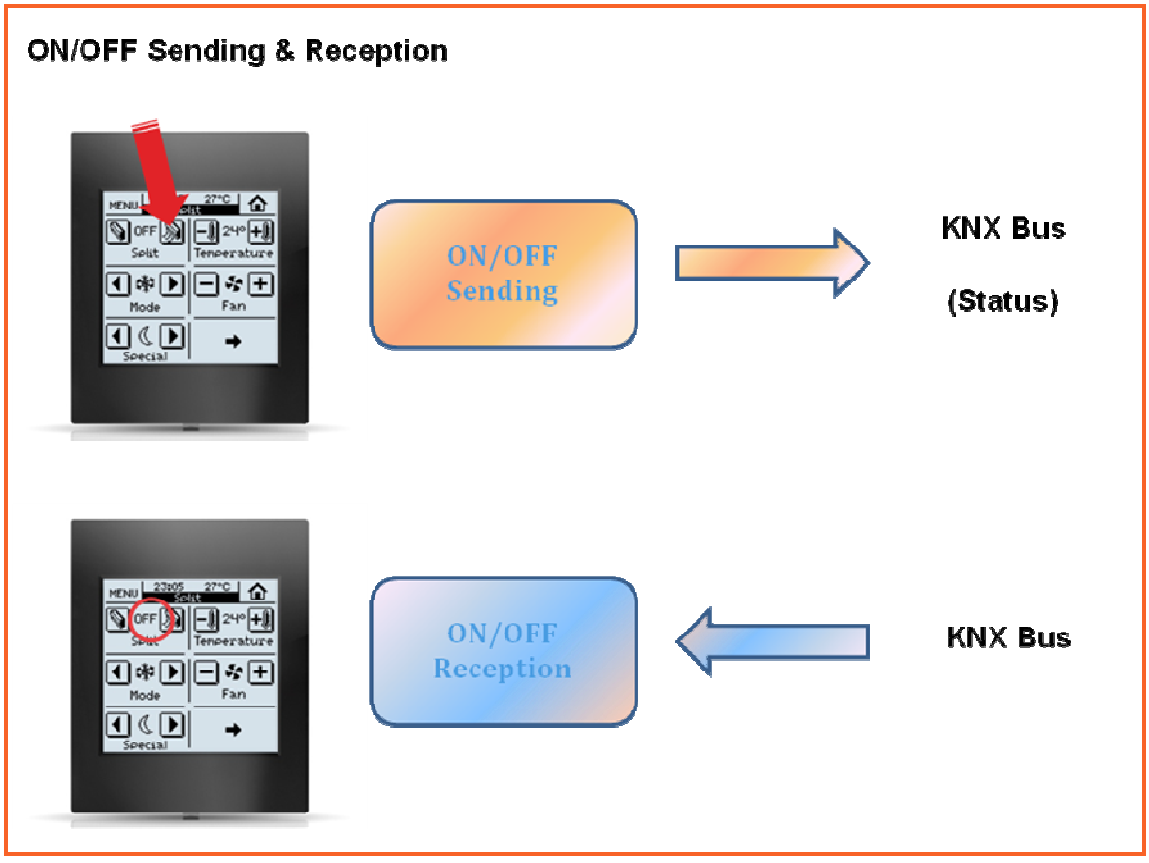


Communication Objects Exchange in the BUS

We have included this section in order to describe the communication object exchange between the touch panel Z38i and the KNX BUS. This way we become familiar with the different Z38i Sending/Reception communication objects and it may give us some ideas for our proyects.

The following schemes show the communication objects exchange between the touch panel and the BUS.

In the first example we can see in the upper part of the figure that when we press the button ON the touch panel sends the "ON/OFF Sending" to the BUS and then it receives from the BUS the object "ON/OFF Reception" which uses for indicating the ON/OFF status in the box.



In the next example we will try to show the temperature sending that the touch panel carries out when a special mode is established through the display and, on the other hand, how the temperature value is received by the touch panel from the KNX BUS.

Temperature Sending & Reception

Temperature Sending

KNX Bus

(Temperature)

Temperature Reception

KNX Bus

When we configure the special modes (in the 5th box) in the Clima page, an arrow appears in the following box that drives us to a special page for configuring the setpoint temperature and the functioning mode for each special mode.