THERMOSTAT

USER MANUAL

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INTRODUCTION

- Several DINUY devices feature the Thermostat function which allow managing the climate control in the room.
- Each Thermostat can be configured to control the Heating, the Air Conditioning, or both.
- By using different control modes, the operation of the different Actuators is managed depending on the current temperature of the room and the set temperature setpoint.

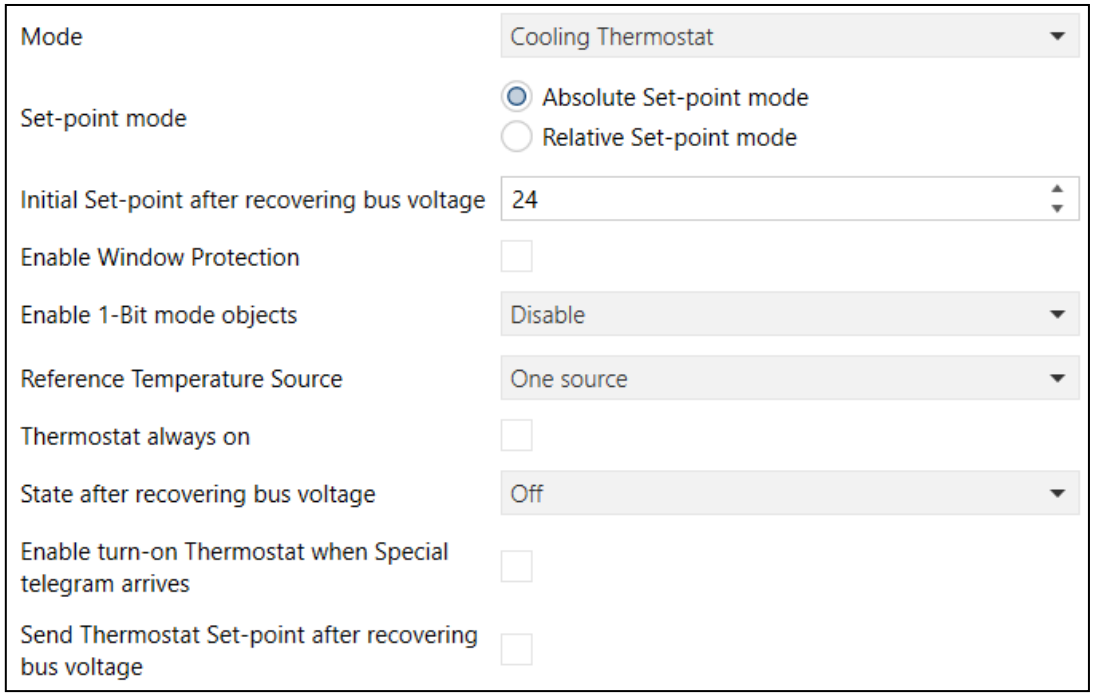
CONFIGURATION

Parameters

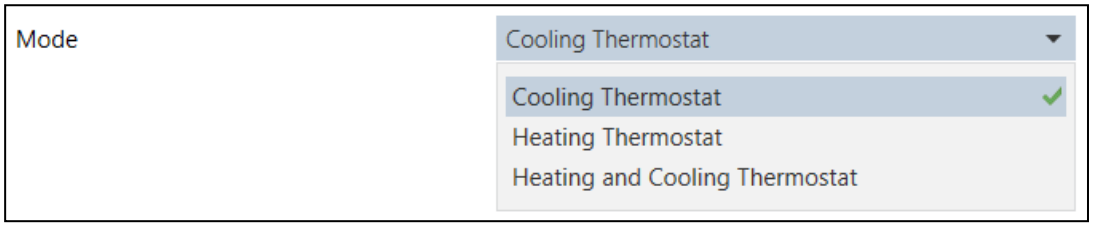
- Basically, the parameters are divided into 3 different blocks:
  - Configuration: a series of general parameters are configured (type of thermostat, temperature setpoint, window alarm...).
  - Cooling/Heating Setpoint: the parameters related to the Heating or Cooling Setpoint are established.
  - Cooling/Heating Regulation Mode: thermostat operating mode is set.

Configuration Parameters

- By default, the established configuration is as follows:

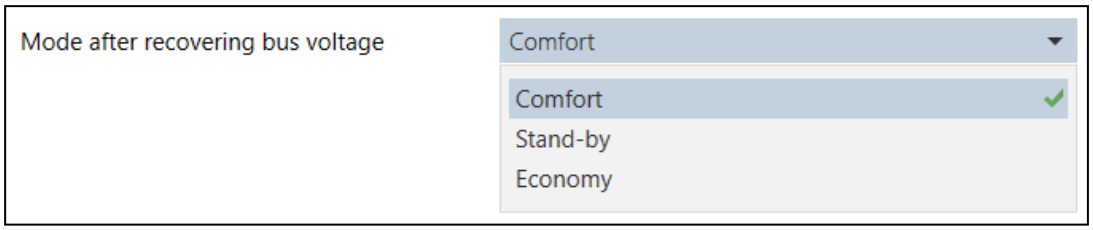


- **Mode**: which of the two main climate working modes will be available, so that the thermostat can manage situations of hot, cool, or both, respectively.



- **Set-point mode**: the configuration and the control of the temperature setpoints.

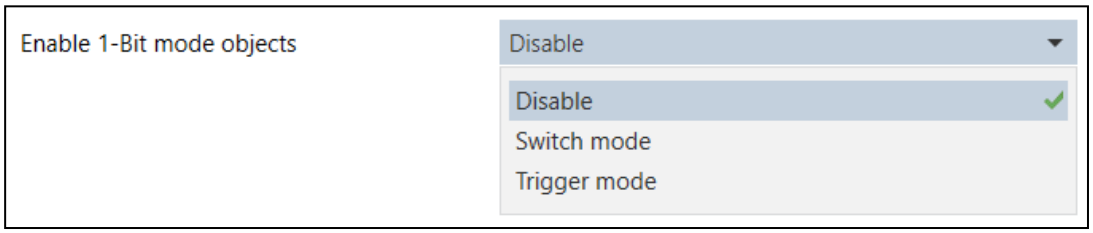
- **Initial Set-point after recovering bus voltage**: sets the initial setpoint after the bus voltage is recovered.
  If "Absolute Set-point mode" has been selected, this value will be the initial setpoint.
  If "Relative Set-point mode" has been selected, this value will be the initial setpoint for the Comfort mode.
- **Mode after recovering bus voltage:** in "Relative Set-point mode" sets the initial special mode after the bus voltage is recovered. This will determine the initial setpoint temperature.



- **Enable Window Protection:** activates or deactivates protection mode in the event of a unusual situation, for example, an open or broken window. It is a protection in preference to the rest of the modes, therefore no other special mode can be activated until the Window Alarm Input changes to "0".

  Once this option is enabled, there are four 1-bit objects "[T] Window Alarm 1..4 Input" that allow monitoring up to 4 different windows.

- **Enable 1-Bit mode objects:** allows to select the desired mode through 4 different 1-bit objects "[T] Special Mode Comfort / Stand-by / Economy / Protection".



However, there is a 1-byte input object "[T] Special mode Input 1 Byte" by default. This object acts over all the bits at the same time and would overlap what has been written with the 1-bit objects. 1-bit objects only write to their mode bit. It can take the following values:

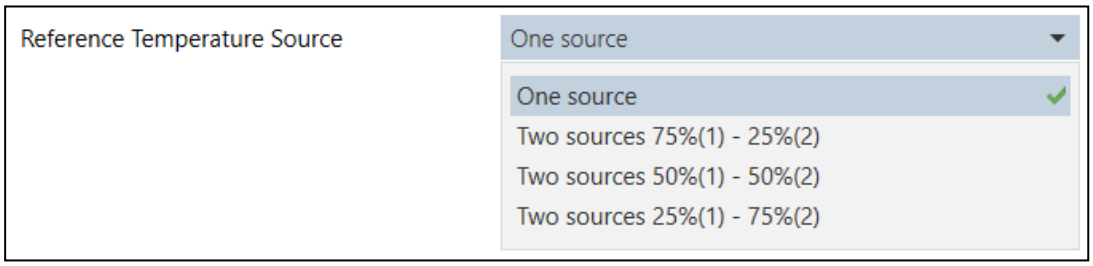
- 00: Auto
- 01: Comfort
- 02: Stand-by
- 03: Economy
- 04: Protection

The four 1-bit objects can work in 2 different ways:

- Switch mode: setting "1" to any of the four 1-Bit objects, the corresponding special mode will be activated. The "0" deactivates the corresponding mode. If a "1" is set in one bit, and then another "1" in another bit, the one with the highest priority will be activated. To remove the "1" from a bit, a "0" must be sent. The order of priority is as follows: Protection > Comfort > Stand-by > Economy.
- Trigger mode: setting "1" to any of the four 1-Bit objects, the corresponding special mode will be activated. The "0" will have no function. By setting a "1" to one bit, as soon as the mode is activated it is automatically set to "0", so if another bit is then activated to "1", there will not be two bits to "1", only the last one.

- **Reference Temperature Source:** sets the source of the temperature value to be taken as the reference.

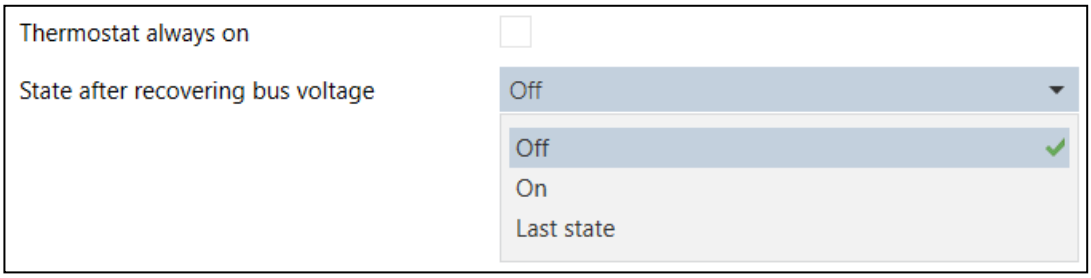
  This value can come from a single source, through the 2-byte object "[T] Temperature Sensor 1", or from the combination of 2 objects in the set proportions. This second value will be established by the 2-byte object: "[T] Temperature Sensor 2".



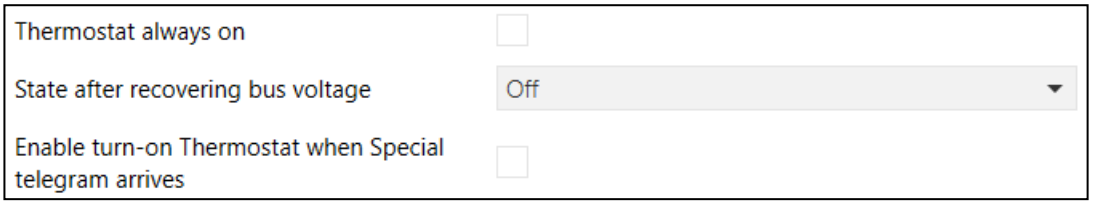
- **Thermostat always on:** it defines if the thermostat will always remain on or if the possibility of switching on/off is given.

  If this option is not marked, two 1-bit objects will be enabled to activate it: "[T] On / Off Input" and "[T] On / Off Feedback".
  In addition, there will be 2 more parameters to be parameterized:

  - **State after recovering bus voltage**: sets the state the thermostat will return when the bus voltage is restored.



  - **Enable turn-on Thermostat when Special telegram arrives**: in case the thermostat is turned off, it will automatically turn on when an activation order of a special mode arrives.



- **Send Thermostat Set-point after recovering bus voltage:** establishes whether or not the temperature setpoint is sent after the bus voltage is recovered.

- **Enable automatic mode change:** defines if the Thermostat changes automatically from one mode to the other one (Heating / Cooling) depending on the setpoint and reference temperatures, or if the change is made manually, through the object "[T] Heating or Cooling Mode".

  If the change is made manually, a "0" in the object "[T] Heating or Cooling Mode" will activate the Cooling mode, and a "1" will activate the Heating mode.

  If on the contrary, the change is made automatically:

  - Reference Temperature > Cooling Setpoint → Cooling mode
  - Reference Temperature < Heating Setpoint → Heating mode

- **Mode after recovering bus voltage:** sets the Thermostat mode after the bus voltage is recovered.

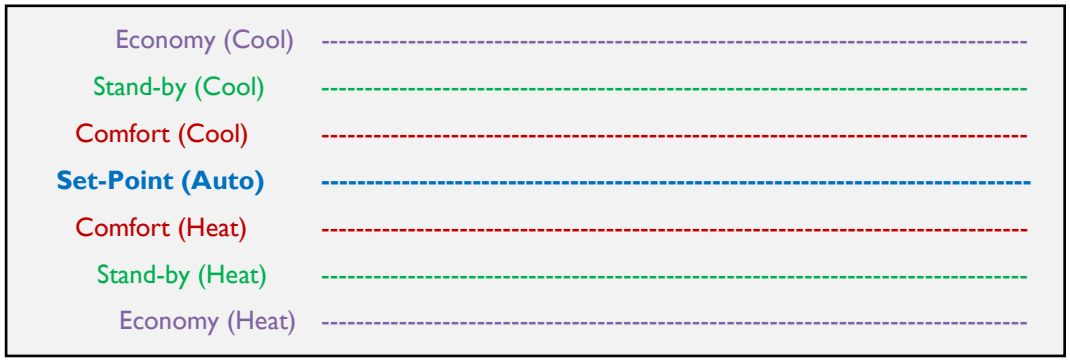
- **Control object:** establishes if there is only one output object, "[T] Output", or if there are different objects for each mode, "[T] Heating Output" and "[T] Cooling Output".

Cooling/Heating Set-point Parameters

Absolute Set-point mode

- The setpoints for cooling or heating are defined as absolute values. Total control over the desired temperature in the room is achieved, since the thermostat regulates the room temperature based on the temperature setpoint set every moment.
- Via the 2-byte communication object "[T] Set-point Input" the desired temperature is set through the bus. Depending on the set value and the parameterized setpoints for each special mode, one mode or another will be established.
- A setpoint value is also defined for the Comfort special mode, from which the setpoints of the other special modes will be defined: Stand-by and Economy.
- Protection mode, of heating or cooling, is defined in absolute values.

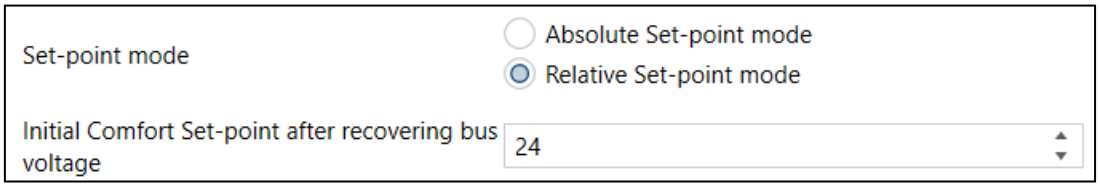
Comfort mode Set-point	5	[x 1ºC]
Offset for Stand-by Set-point mode	64	[x 0,1ºC]
Offset for Economy Set-point mode	96	[x 0,1ºC]
Over-Temperature Protection Set-point	40	[x 1ºC]

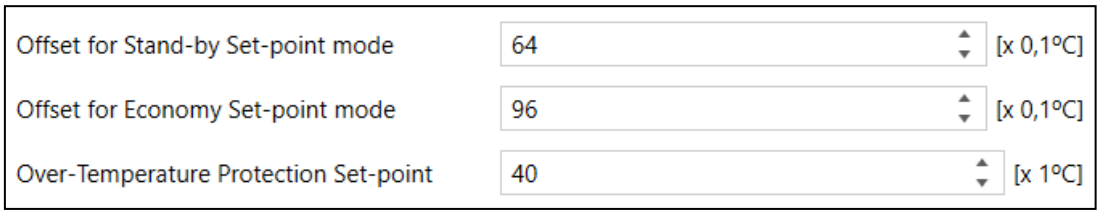


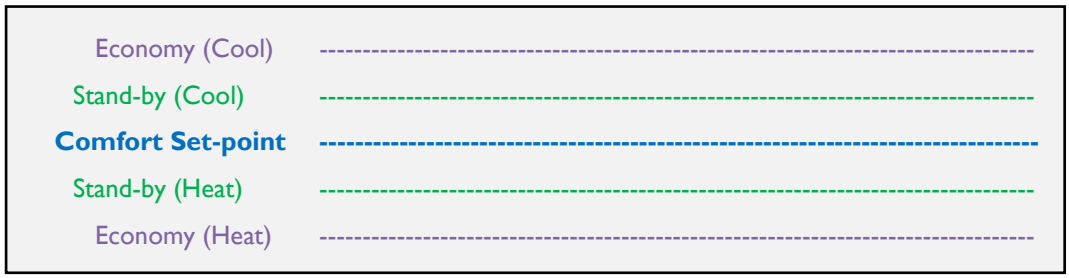
- **Comfort mode Set-point:** The temperature under this special mode must guarantee the comfort of the people present in the room. This mode is intended to perform usual climate control when the room is being occupied.
- **Offset for Stand-by Set-point mode:** This mode is intended for short periods during which the room remains empty. A standby or standby temperature is enabled that will allow energy savings. This value should be set by means of an offset relative to the absolute setpoint defined for the Comfort mode according to the parameterized operating mode (cooling, heating or both, in which case it will be necessary to define a Comfort setpoint for heating and another for cooling). This mode is usually used when the room is going to be empty for a short period of time.
- **Offset for Economy Set-point mode:** This mode is usually used when the air-conditioned room is going to be empty for longer periods of time. This value will be set by means of an offset relative to the absolute setpoint defined for the Comfort mode according to the parameterized operating mode (cooling, heating or both, in which case it will be necessary to define a Comfort setpoint for heating and another for cooling).
- **Over-Temperature Protection Set-point:** This value will be activated in case of adverse climate conditions, excessive heat or cold, mainly due to some unusual external situation (such as a broken window) or because the room is going to remain empty for a long time. The thermostatic control will only be activated if the thermostat is on and with the protection mode activated and when the room temperature is actually above or below the parameterized protection setpoints, thus avoiding excessive energy consumption.

Relative Set-point Mode

- It consists of the application of set-points in relative terms, that is, a Comfort set-point temperature will be set by parameter and each of the set-points of the modes is configured by a relative offset with respect to this base reference, both for cooling and for heating.
- With the 2-byte communication object "[T] Comfort Set-point Input" the Comfort set-point is set via bus, which will be taken as a reference to define the other special modes.
- Protection mode, for heating or cooling, is defined in absolute values.







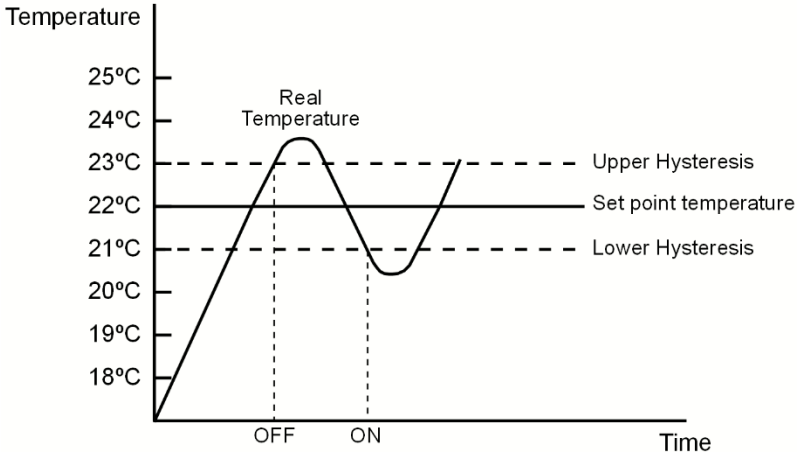
- **Initial Comfort Set-point after recovering bus voltage:** Initial setpoint for Comfort mode which will be taken as base reference for the other modes, with the exception of Protection mode.
- **Offset for Stand-by Set-point mode:** This value will be set by a relative offset from the absolute setpoint defined for the Comfort mode according to the parameterized operating mode (cool, heat or both, in which case it will be necessary to define a Comfort setpoint for heating and another for cooling). This mode is usually used when the room is going to be empty for a short period of time. A standby temperature is enabled allowing energy savings.
- **Offset for Economy Set-point mode:** This value will be set by a relative offset from the absolute setpoint defined for the Comfort mode according to the parameterized operating mode (cool, heat or both, in which case it will be necessary to define a Comfort setpoint for heating and another for cooling). This mode is usually used when the room is going to be empty for longer periods of time, for example, when people will not use the room again until the next day.
- **Protection Set-point:** This value will be activated in case of adverse climate conditions, excessive heat or cold, mainly due to some abnormal external situation (such as a broken window) or because the room is going to remain empty for a long time. The thermostatic control will only be activated if the thermostat is on and with the protection mode activated and when the room temperature is really above or below the parameterized protection setpoints, thus avoiding excessive energy consumption.

Cooling/Heating Regulation Mode Parameters

- Thermostatic control can be carried out in 2 different algorithms:
  - 2-point Hysteresis Control.
  - PI control.

2-point Hysteresis Control

It is a simple control method, widely used in conventional thermostats, where the Set-point Temperature and two values of hysteresis around the setpoint are required. It prevents a continuous switching between the two modes.

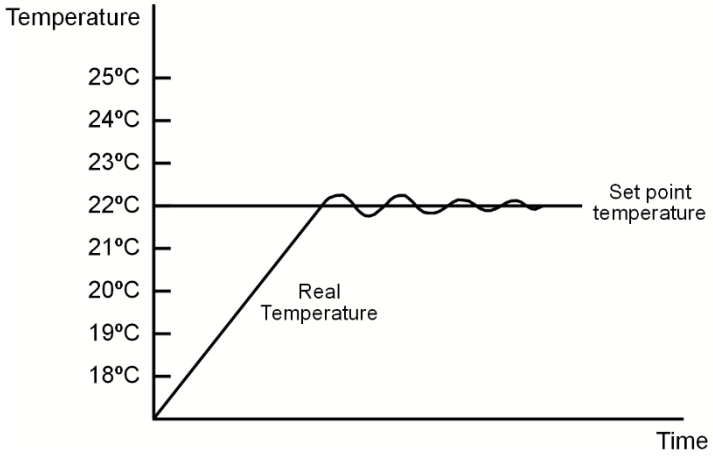


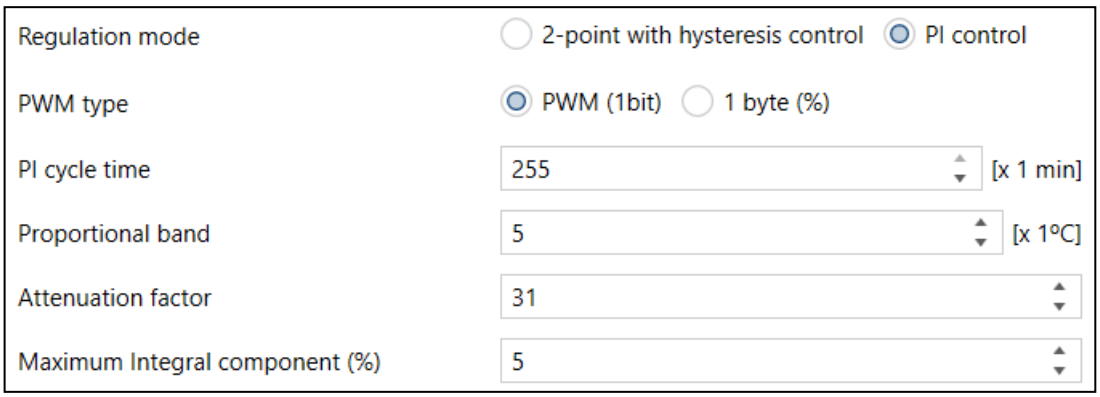
Regulation mode	(•) 2-point with hysteresis control ( ) PI control	
Higher Hysteresis	10	[x 0,1ºC]
Lower Hysteresis	10	[x 0,1ºC]
Forwarding period (0=Disable)	0	[x 1 min]

PI Control (Proportional – Integral)

More advanced and accurate linear control than the 2-point hysteresis control, since besides taking into account the difference between the temperature setpoint and the actual temperature, it takes into account previous states or differences.

In this way, the oscillations with respect to the setpoint value are reduced and the ambient temperature becomes progressively stable around the setpoint.





- **PWM type:**
  - **PWM (1 bit):** control by Pulse Width Modulation. One 1-Bit object "[T] Cooling / Heating Output" will be available to control on/off valves, not allowing intermediate positions. Therefore, partial opening of the valve is emulated by opening and closing it for similar portions of time.
  - **1 byte (%):** the control object "[T] Cooling / Heating Output" will be a 1-Byte percentage value. It will indicate how much (%) the valve should open, as long as the valve admits this positioning.

- **PI cycle time:** this time is considered for setting the temperature sampling frequency and therefore the update frequency of the control signal. High values should be selected for systems with high thermal inertia (~ 20min) and lower values for systems with lower thermal inertia (~ 10min).

- **Proportional band:** resulting value between the setpoint temperature and the actual temperature from which the proportional integral value will be applied.
  - If the difference between the actual temperature and the setpoint temperature is **higher** than the parameter "Proportional band", the Thermostat output will be 100%.
  - If the difference between the actual temperature and the setpoint temperature is **lower** than the parameter "Proportional band", the Thermostat output will be the result of the addition of two values:
    - Proportional value: The Proportional value (rule of three) between the difference "Setpoint temperature" - "Actual temperature" in the case of heating thermostat, or "Actual temperature" - "Setpoint temperature" in the case of cooling thermostat, with respect to the parameter "Proportional band".
    - Integral value: This value is the result of adding the difference between the "Actual Temperature" and the "Setpoint temperature" in each integration cycle. The "Attenuation Factor" is applied to this sum and the resulting value is added to the "Proportional Value" if it is less than the "Maximum Integral Component" value. Otherwise, the value "Maximum Integral Component" is added.

    The result can never be higher than 100%.

- **Attenuation factor:** attenuation that is applied to the Integral value before adding it to the Proportional value.

- **Maximum Integral component (%):** Integral value limitation.

Communication Objects

Number	Name	Object Function	Length	C	R	W	T	U	Data Type	Priority
533	[T1] On/Off Feedback	1 = On; 0 = Off	1 bit	C	-	-	T	-	switch	Low
534	[T1] On/Off Input	1 = On; 0 = Off	1 bit	C	-	W	-	-	switch	Low
535	[T1] Set-point Feedback	Current Set-point	2 bytes	C	-	-	T	-	temperature (°C)	Low
536	[T1] Comfort Set-point Input	Comfort Set-point	2 bytes	C	-	W	-	-	temperature (°C)	Low
537	[T1] Heating Output	Output (2-point with Hysteresis)	1 bit	C	-	-	T	-	switch	Low
538	[T1] Cooling Output	Output (PWM Proportional - Integral)	1 bit	C	-	-	T	-	switch	Low
539	[T1] Temperature Sensor 1	Input Temperature Sensor 1	2 bytes	C	-	W	-	-	temperature (°C)	Low
540	[T1] Temperature Sensor 2	Input Temperature Sensor 2	2 bytes	C	-	W	-	-	temperature (°C)	Low
541	[T1] Special mode Feedback	2 Bytes mode Feedback	2 bytes	C	-	-	T	-	RHCC status	Low
542	[T1] Special mode Input 1 Byte	1 Byte mode HVAC	1 byte	C	-	W	-	-	HVAC mode	Low
543	[T1] Special mode Economy	0 = Off; 1 = On	1 bit	C	-	W	-	-	switch	Low
544	[T1] Special mode Stand-by	0 = Off; 1 = On	1 bit	C	-	W	-	-	switch	Low
545	[T1] Special mode Protection	0 = Off; 1 = On	1 bit	C	-	W	-	-	switch	Low
546	[T1] Special mode Comfort	0 = Off; 1 = On	1 bit	C	-	W	-	-	switch	Low
547	[T1] Heating or Cooling mode Status	0=Cooling; 1=Heating	1 bit	C	-	-	T	-	cooling/heating	Low
548	[T1] Heating or Cooling mode	0=Cooling; 1=Heating	1 bit	C	-	W	-	-	cooling/heating	Low
549	[T1] Window Alarm 1 Input	0=No Alarm; 1=Alarm	1 bit	C	-	W	-	-	alarm	Low
550	[T1] Window Alarm 2 Input	0=No Alarm; 1=Alarm	1 bit	C	-	W	-	-	alarm	Low
551	[T1] Window Alarm 3 Input	0=No Alarm; 1=Alarm	1 bit	C	-	W	-	-	alarm	Low
552	[T1] Window Alarm 4 Input	0=No Alarm; 1=Alarm	1 bit	C	-	W	-	-	alarm	Low

Number	Name	Object Function	Description
533	[T] On/Off Feedback	1 = On; 0 = Off	If "Thermostat always on" is not selected, it allows knowing its status
534	[T] On/Off Input	1 = On; 0 = Off	If "Thermostat always on" is not selected, it is possible to switch it on/off with this object
535	[T] Set-point Feedback	Current Set-point	Information object about the Set-point Temperature
536	[T] Set-point Input	Set-point	Setpoint input. If "Relative Set-point mode" is selected, this value will be the Comfort Setpoint
537	[T] Heating Output	Output	Output object for valve control. It can be a 1-Bit or 1-Byte value, depending on whether the control is done by PWM or by percentages
538	[T] Cooling Output	Output	Output object for valve control. It can be a 1-Bit or 1-Byte value, depending on whether the control is done by PWM or by percentages
539	[T] Temperature Sensor 1	Input Temperature Sensor 1	Input temperature value from an external sensor
540	[T] Temperature Sensor 2	Input Temperature Sensor 2	Input temperature value from an external sensor
541	[T] Special mode Feedback	2 Bytes mode Feedback	Information about the Special state the

			Thermostat is in
542	[T] Special mode Input 1 Byte	1 Byte mode HVAC	Select a specific Special mode
543	[T] Special mode Economy	0 = Off, 1 = On	1-bit object to activate Economy mode
544	[T] Special mode Stand-by	0 = Off, 1 = On	1-bit object to activate Stand-by mode
545	[T] Special mode Protection	0 = Off, 1 = On	1-bit object to activate Protection mode
546	[T] Special mode Comfort	0 = Off, 1 = On	1-bit object to activate Comfort mode
547	[T] Heating or Cooling mode Status	0 = Cooling, 1 = Heating	Information about the status of the Thermostat: Heating or Cooling
548	[T] Heating or Cooling mode	0 = Cooling, 1 = Heating	Allows to activate the Heating or Cooling mode manually. This object will be active as long as automatic mode change is not enabled
549	[T] Window Alarm 1 Input	0 = No Alarm, 1 = Alarm	1-bit alarm object. It allows to control an open or a broken window. Its priority is higher than the rest of the modes, so no other special mode can be activated until the window status becomes "0"
550	[T] Window Alarm 2 Input	0 = No Alarm, 1 = Alarm	
551	[T] Window Alarm 3 Input	0 = No Alarm, 1 = Alarm	
552	[T] Window Alarm 4 Input	0 = No Alarm, 1 = Alarm	