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CONTROL YOUR LIVING SPACE



## Application manual

**Multisensor T - R.H. - CO2 eq.  
KNX Room Temperature controller**

**EK-ET3-TP**

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| Revision | Updating                                                      | Author       | Date       |
|----------|---------------------------------------------------------------|--------------|------------|
| 1.0      | First version                                                 | G. Schiochet | 20/03/2018 |
| 1.1      | Update for Ekinex S.p.A. and minor changes involving pictures | G. Schiochet | 26/06/2019 |
| 2.0      | Deleted the scenes management feature                         | G. Schiochet | 27/09/2019 |
| 2.1      | Minor corrections                                             | G. Schiochet | 14/02/2019 |
| 2.2      | Relative setpoint objects corrected                           | G. Schiochet | 15/06/2019 |
| 2.3      | Signaling LED color corrected (Chapter 4)                     | G. Schiochet | 29/09/2020 |
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|          |                                                               |              |            |

The latest revision of the application manual is available at [www.ekinex.com](http://www.ekinex.com). For previous revisions, contact the technical support at [support@ekinex.com](mailto:support@ekinex.com).

## Foreword

The present document describes the ekinex® Multisensor KNX controller for the temperature, relative humidity (R.H.) and CO<sub>2</sub> equivalent measurement, version EK-ET3-TP....

## 1 General information

The device described in the present document works as an electronic digital temperature controller for a room or a zone (consisting e.g. in a group of rooms or a whole floor) of a building and is part of the secondary regulation for heating and cooling. The room temperature controller was developed according to the KNX standard for use in systems of control of homes and buildings, and is equipped with 3 integrated sensors: temperature, relative humidity and air quality. In particular, the air quality measurement is done by means of a VOC (Volatile Organic Compound) sensor, with CO<sub>2</sub> equivalent output signal.

The Multisensor can also work as a controller for these 3 parameters, that are available for a single zone to be managed. Up to 8 integrated LEDs with lightpipe can be configured, in order to display the operating thresholds for the CO<sub>2</sub> equivalent, the activation of the humidification/dehumidification functionality and the cooling/heating working modes.

The device is equipped with an integrated KNX bus communication module and is designed for wall installation on a flush mounting box. Both the programming button and LED are located in the front of the device below the rocker, as well as the 3 sensors. The device is powered by the KNX bus line and does not require any auxiliary power supply.

### 1.1 Function

The main function of the device is to control the temperature of the air mass of the room by means of the actual temperature ( $T_{eff}$ ), measured by the device itself or received by the bus, and of the setpoint temperature ( $T_{set}$ ) set by the user; comparing the two values and a series of parameters set before the commissioning, the regulation algorithm of the device calculates the control variable value that is converted to a telegram and transmitted on the bus toward KNX actuators (such as binary outputs, fan-coil controllers, valve drives, etc.) able to control the operation of heating and cooling terminal units.

Two decision thresholds are available for the temperature, to control the activation/deactivation of the heating/cooling system. At the same time, two independently configurable thresholds can be managed for the relative humidity, as well as three thresholds for the air quality parameter.

As soon as the measured values go below or above the thresholds, it is possible to manage a corresponding action; e.g., if the CO<sub>2</sub> equivalent concentration is too high, a message over the bus to the actuators can be sent, in order to activate fans for the air mass circulation in the room. In the same way, if an excessive relative humidity is detected by the sensors, a message over the bus can be sent, to activate the room dehumidification.

### 1.2 Main functional features

The main functions carried out by the device are:

- Temperature, relative humidity and air quality (CO<sub>2</sub> equivalent) measuring through the integrated sensors, with possibility of sending the read valued on the bus;
- Two-point (ON/OFF) or proportional (PWM or continuous) room temperature regulation;
- Seasonal modes: heating and cooling with possibility of either local or via bus seasonal changeover;
- Operating modes: comfort, standby, economy and building protection with different setpoint for heating and cooling functions;
- Automatic switching of the operating modes through presence sensor or window contact;
- Weighted average of two temperature values;

- Dew-point temperature computation;
- Temperature regulation (measured and setpoint, as °C), relative humidity (measured and setpoint in percentage), air quality (as CO<sub>2</sub> equivalent concentration, in ppm), alarms and errors (with alphanumeric coding);
- Relative humidity thresholds setting;
- CO<sub>2</sub> equivalent thresholds setting;
- Compatibility with common external sensors, connected to the bus by means of KNX devices, that are able to send either state or value messages over the bus;
- Floor temperature limitation and antincondensation (for radiant panels);
- Delayed start of a fan ("hot-start") with time-scheduling or depending on the water temperature measured at the coil for thermal exchange;
- Logic functions (AND, OR, NOT and XOR) availability, in order to implement complex functions in the building automation system.

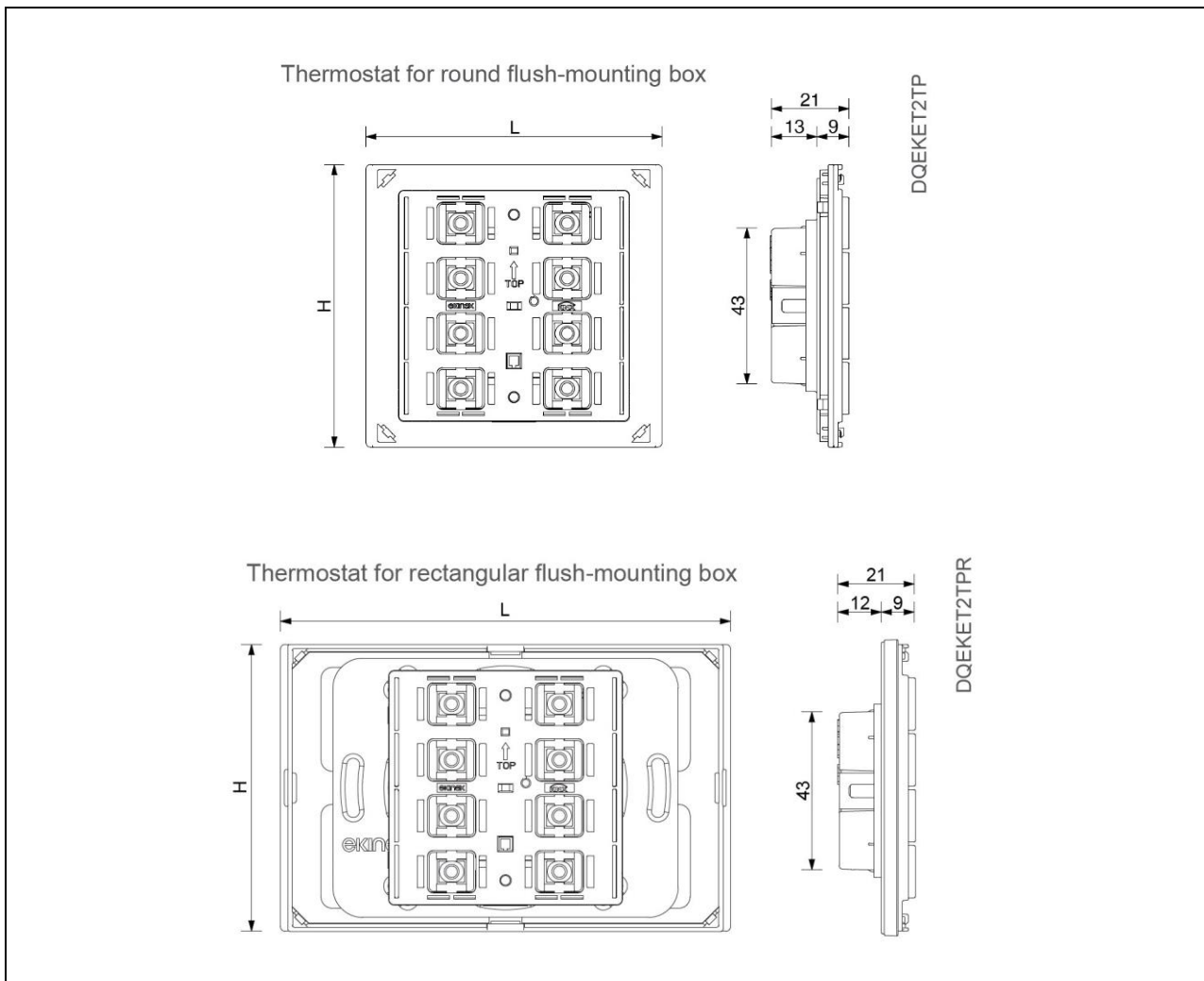
## 1.3 Technical data

| Feature                      | Valore                                                                                                                                                                                                                                         |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device                       | KNX S-mode bus device                                                                                                                                                                                                                          |
| Communication                | according KNX TP1 standard                                                                                                                                                                                                                     |
| Use                          | dry internal rooms                                                                                                                                                                                                                             |
| Environmental conditions     | <ul style="list-style-type: none"> <li>• Operating temperature: - 5 ... + 45°C</li> <li>• Storage temperature: - 25 ... + 55°C</li> <li>• Transport temperature: - 25 ... + 70°C</li> <li>• Relative humidity: 95% not condensating</li> </ul> |
| Power supply                 | SELV 30 Vdc from bus KNX (auxiliary power supply not necessary)                                                                                                                                                                                |
| Current consumption from bus | < 13 mA                                                                                                                                                                                                                                        |
| Programming elements         | 1 pushbutton and 1 LED (red) on the front side                                                                                                                                                                                                 |
| Display elements             | 2 red, 5 blue, 2 white, 1 green LEDs                                                                                                                                                                                                           |
| Integrated sensors           | Temperature, relative humidity and air quality                                                                                                                                                                                                 |
| Installation                 | On round or square wall-mounting box with distance between fixing holes of 60 mm                                                                                                                                                               |
| Connection                   | • bus: black/red KNX terminal block                                                                                                                                                                                                            |
| Protection degree            | IP20                                                                                                                                                                                                                                           |
| Dimensions (WxHxD)           | 81 x 77 x 24 mm                                                                                                                                                                                                                                |

## 1.4 Design

The device is realised for wall-mounting on either round or square wall box with distance between fixing holes of 60 mm, or rectangular flush-mounting box (3 slots, italian standard) with distance between fixing holes of 83,5 mm.

The multisensor requires a metal support and a plastic adapter for mounting, that have to be ordered separately. The terminal block for KNX bus line is included in the package.



Picture 1 - device execution: frontal and lateral view

## 1.5 Delivery

The delivery includes the screws for mounting and the terminal block for the connection of the bus. The metal support, the plastic adapter, the plate and the frame (if necessary) must be ordered separately. For further information please refer to ekinex<sup>®</sup> product catalog or visit [www.ekinex.com](http://www.ekinex.com).

## 1.6 Accessories

The device has to be completed with a square rocker 60 x 60 mm and 1 or 2 places plate, with one 60 x 60 mm window. An ekinex<sup>®</sup> Form o Flank frame is also required, except for 'NF - No Frame version.

The rocker is available in square modularity, plastic material and three color variations. The square and rectangular frames are available in 2 form solutions (Form and Flank), plastic or aluminium material and several colors and finishes.

The 'NF – no frame versions are mounted without frame. They show a side profile, that can be ordered in either black or white color. The programming button and LED are located in the front side, below the rocker. The back side of the case hosts the terminal block for KNX bus line.

| Code      | Mounting                                                            | Plate                                                                                         | Rocker     |
|-----------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------|
| EK-ET3-TP | With frame (Form or Flank series) or without ('NF – no frame serie) | EK-PQS-..., 1 posto, 60x60<br>EK-P2G-..., 2 posti, 55x55, 60x60<br>EK-P2S-..., 2 posti, 60x60 | EK-T1Q-... |
|           | With frame (Form or Flank series) or without ('NF – no frame serie) | EK-PRS-..., 1 posto, 60x60<br>EK-P2G-..., 2 posti, 55x55, 60x60<br>EK-P2S-..., 2 posti, 60x60 |            |

**Table 1 - Accessories of the device: set of rockers and frames**

## 1.7 Marks and certification

The KNX mark on the ekinex device ensures interoperability with the KNX devices of EKINEX and other manufacturers installed on the same system bus system. The compliance with the applicable European directives is indicated by the presence of the CE mark.

## 2 Installation

The device has degree of protection IP20, and is therefore suitable for use in dry interior rooms. The installation of the device requires the following steps:

- fix the metal support with the screws supplied on a wall box with suitable fixing holes. It is recommended to install the device at a height of 150 cm;
- snap a square frame of the form or flank series, inserting it from the rear of the device;
- insert the terminal for the bus, previously connected to the bus cable, in its slot on the rear side. Connect the sensors (if foreseen) to the device inputs. At this point it is recommended to carry out the commissioning of the device or at least the download of the physical address;
- install the device on the metal support through the spring system, tightening then the two screws requires also to tighten the screws included in the delivery. For mounting the device follow also the indication TOP (arrow tip pointing up) on the rear side of the device.



### Note on mounting screws

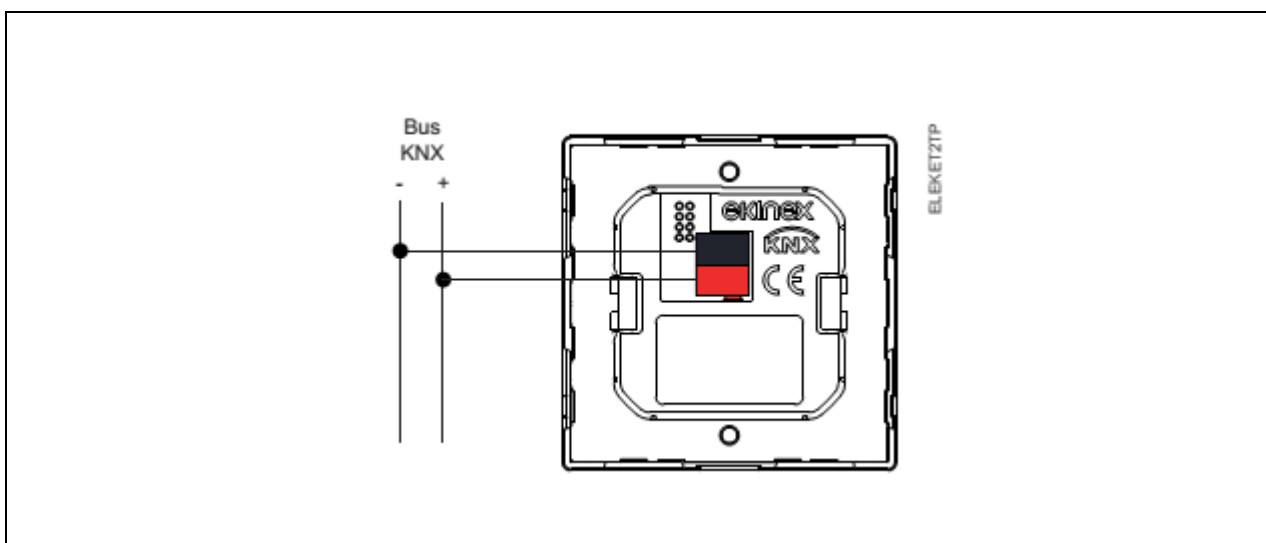
The screws for the metal support must be tightened with a max. torque of 1.0 Nm.

### 2.1 Connection

For the operation the device has to be connected to the bus line and addressed, configured and commissioned with ETS (Engineering Tool Software). The connection of the KNX bus line is made with the terminal block (red/black) included in delivery and inserted into the slot of the housing.

#### Characteristics of the KNX terminal block

- spring clamping of conductors
- 4 seats for conductors for each polarity
- terminal suitable for KNX bus cable with single-wire conductors and diameter between 0.6 and 0.8 mm
- recommended wire stripping approx. 5 mm
- color codification: red = + (positive) bus conductor, black = - (negative) bus conductor



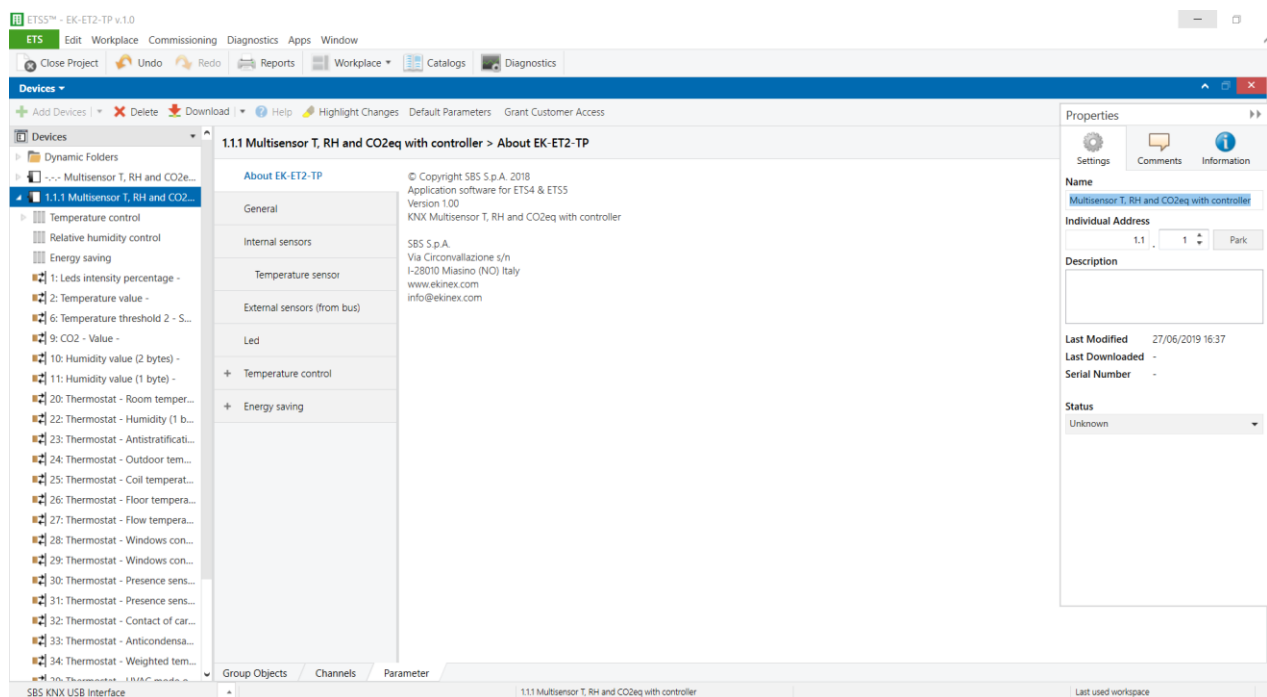
Picture 2 - Connection of the device of the bus line

## 3 Configuration and commissioning

The configuration and commissioning are carried out with the ETS (Engineering Tool Software) tool and the ekinex® application program provided free of charge by EKINEX; you do not need any additional software or plug-in tool. For further information on ETS see also [www.knx.org](http://www.knx.org).

### 3.1 Configuration

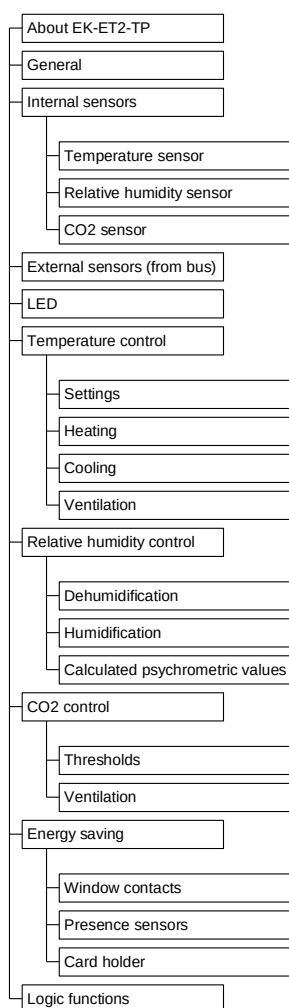
The device functionality is defined by the settings done via software. The configuration requires necessarily ETS4 (or later releases) and the ekinex® APEKET3TP##.knxprod (## = release) application program that can be downloaded from the website [www.ekinex.com](http://www.ekinex.com). The application program allows the configuration of all working parameters for the device. The device-specific application program has to be loaded into ETS or, as alternative, the whole ekinex® product database can be loaded; at this point, all the instances of the selected device type can be added to the project. The configurable parameter details are described in this application manual.



Picture 3 - Application program for ETS APEKET3TP##.knxprod (## = version)

## 3.1.1 Tree structure of the application program

At its opening, the tree structure of the program includes the following main items:



Other items may appear depending on the choices done for the parameters of the folders.

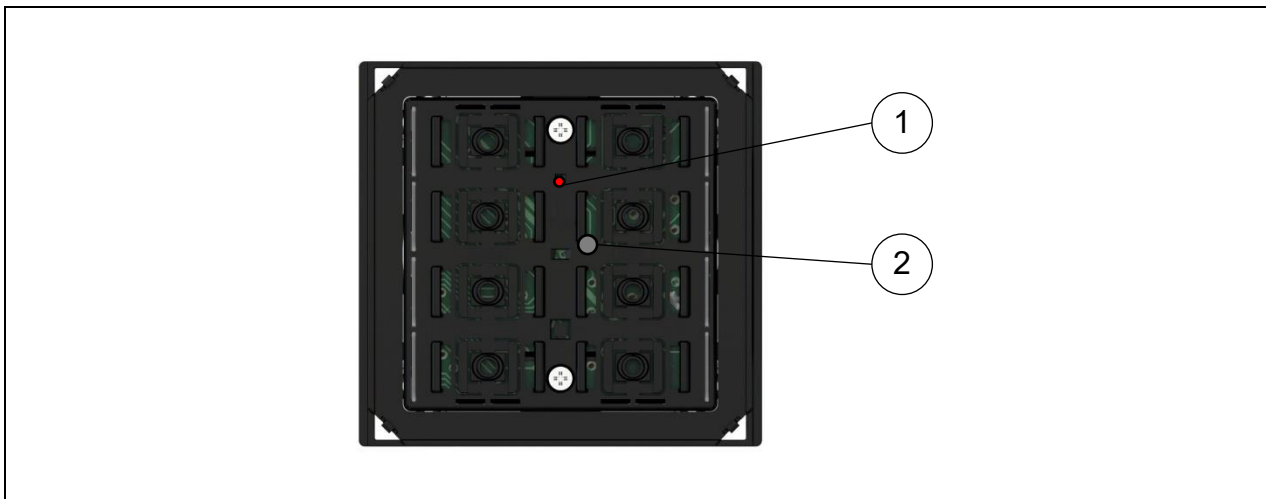
## 3.1.2 Languages of the application program

The application program is available in four languages: English, Italian, German and French. The language displayed can be changed in ETS choosing "Settings / Presentation language".

### 3.2 Commissioning

For commissioning purposes, as shown in Picture 4, the device is provided on the front side (in the area usually occupied by the rocker) of the following elements:

- a red LED (1) for indication of the active operating mode (LED on = programming, LED off = normal operation);
- a pushbutton (2) for switching between the normal and programming operating mode.



Picture 4 - Device programming: led (1) and pushbutton (2)

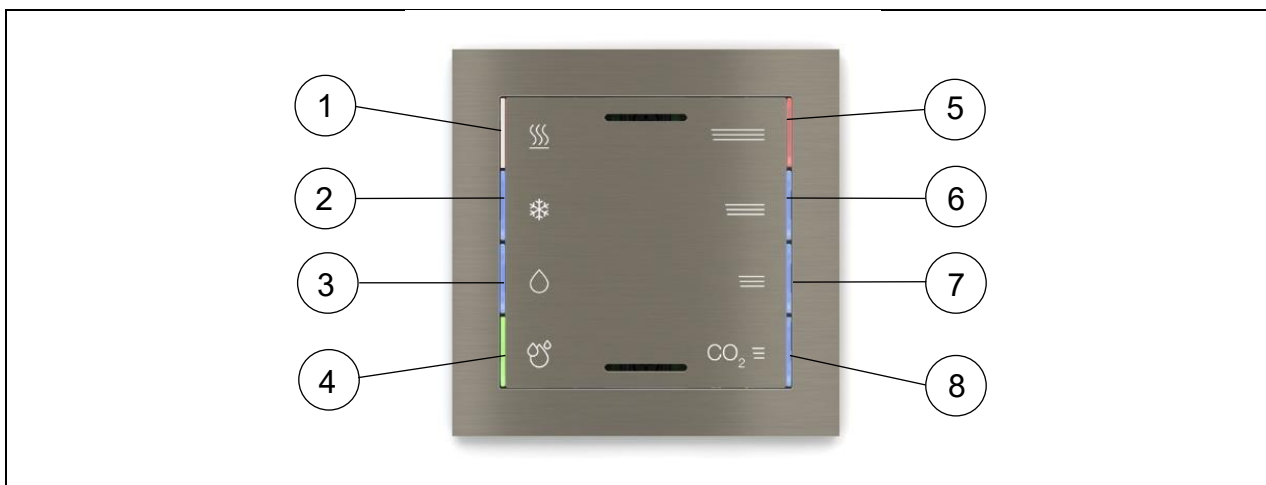
For the device commissioning, the following activities are required:

- make the electrical connections;
- turn on the bus power supply;
- switch the device operation to the programming mode by pressing the programming pushbutton located on the front side of the housing. In this mode of operation, the programming LED is turned on;
- download into the device the physical address and the configuration with the ETS® program.

At the end of the download, the operation of the device automatically returns to normal mode; in this mode the programming LED is turned off. Now the bus device is programmed and ready for use.

## 4 User interface

The user interface of the room temperature controller includes 8 LED with lightpipes for signalling purposes. They are installed at both sides of the device and aim to show the relative humidity and CO<sub>2</sub> equivalent working thresholds, and the heating/cooling seasonal modes.



Picture 5 - LED indications for heating/cooling, dehumidification/humidification and air quality

With reference to Picture 5, the displayed information are:

- White / red LED (1) for indication of the heating mode functionality ON / heating ON;
- White / blue LED (2) for indication of the cooling mode functionality ON / cooling ON;
- Blue LED (3) for indication of the dehumidification functionality ON;
- Green LED (4) for indication of the humidification functionality ON;
- Red LED (5) for indication that the measured CO<sub>2</sub> equivalent exceeds threshold 3;
- Blue LED (6) for indication that the measured CO<sub>2</sub> equivalent lies between threshold 2 and 3;
- Blue LED (7) for indication that the measured CO<sub>2</sub> equivalent lies between threshold 1 and 2;
- Blue LED (8) for indication that the measured CO<sub>2</sub> equivalent lies below threshold 1.

## 5 Integrated sensors

As already mentioned in the General information chapter, the Multisensor device is equipped with 3 integrated sensors, all located under the plastic half-shell (please refer to Picture 6): temperature, relative humidity (2) and air quality (3). The air quality measurement is done by means of a OVC (Organic Volatile Compound) sensor, providing a CO<sub>2</sub> equivalent output signal.

## 5.1 Temperature sensor

The integrated temperature sensor allows the measure of the room temperature in the range from 0 °C to +40 °C with a resolution of 0.1 °C. To keep into account significant environmental interferences such as the proximity to heatsources, the installation on an outer wall, the chimney effect due to rising warm air through the corrugated tube connected to the wall-mounting box, the measured value can be corrected by means of a offset of  $\pm 5$  K or, preferably, can be used a weighted average value between two values of temperature chosen from the following ones: value measured by the integrated sensor, value measured by a temperature sensor connected to one of the inputs of the device, value received via bus from any KNX device (e.g., ekinex pushbuttons).

In Picture 6, the temperature sensor is placed in position (1).

## 5.2 Relative Humidity sensor

The relative humidity sensor allows to measure the room relative humidity value. This value can be used to manage an advance room thermal regulation and to enlarge the safety working conditions for some cooling terminal systems.

In the next chapters, a detailed explanation on how the relative humidity value can be sent over the bus by using the specific communication object 10 (for 2 bytes) and 11 (for 1 byte) will be shown. The Multisensor device applies a logic for the computation and the sending over the bus of the dew-point temperature psychrometric value, by means of the combined measurements of temperature and relative humidity.

In Picture 6, the relative humidity sensor is placed in position (2).

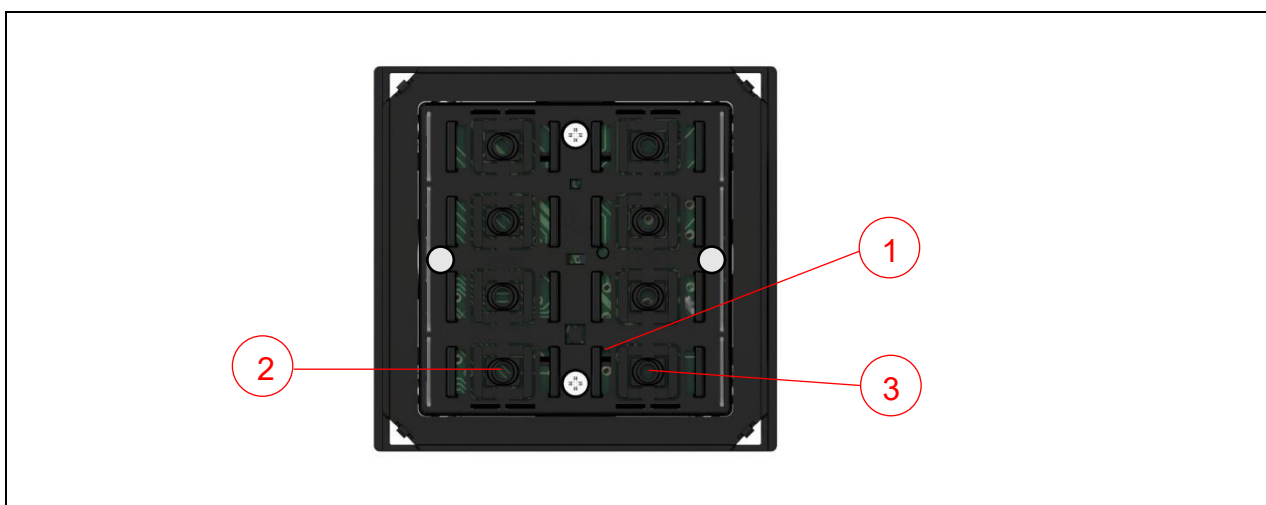
## 5.3 Air quality sensor

The integrated air quality sensor applies a dynamic correction algorithm and a set of parameters saved in the memory, to provide 2 complementary signals of air quality: the first one is the TVOC (Total Volatile Organic Compound) component, while the second is the CO<sub>2</sub> equivalent.

The output values are included in a range from 0 and 60000 ppb (parts per billion) for the TVOC signal, while the CO<sub>2</sub> equivalent component can fluctuate between 400 and 60000 ppm (parts per million).

The sampling frequency is fixed to 1 Hz for both signal components.

In Picture 6, the air quality sensor is placed in position (3).



Picture 6 - Integrated sensors placement

## 6 Input variables

The data that the device uses in its control algorithms and /or to be displayed may come from:

- the internal sensors;
- the KNX bus through standard Communication Objects.

The processed data can also be transmitted on the KNX bus as Communication Objects. The classification of the input variables is shown in Table 2.

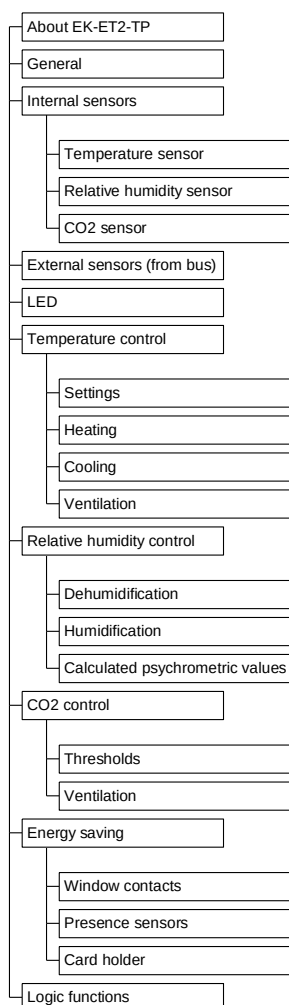
| Data                             | Coming from                             | Description                                                                                |
|----------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------|
| Room temperature                 | Internal sensor                         | Analogic value for thermoregulation functions – Object 2 ( 2 byte)                         |
| Room relative humidity           |                                         | Analogic value for thermoregulation functions – Object 10 ( 2 byte) and Object 11 (1 byte) |
| CO <sub>2</sub> equivalent       |                                         | Analogic value for thermoregulation functions – Object 9 ( 2 byte)                         |
| Room temperature                 | KNX bus (through communication objects) | Objects 20 (2 byte)                                                                        |
| Humidity                         |                                         | Object 21 (2 bytes) and Object 22 (1 byte)                                                 |
| Antistratification temperature   |                                         | Object 23 (2 bytes)                                                                        |
| Outdoor temperature              |                                         | Object 24 (2 bytes)                                                                        |
| Exchange coil temperature        |                                         | Object 25 (2 bytes)                                                                        |
| Floor surface temperature        |                                         | Object 26 (2 bytes)                                                                        |
| Conveying fluid flow temperature |                                         | Object 27 (2 bytes)                                                                        |
| Presence of condensation         |                                         | Object 33 (1 bit)                                                                          |
| Window state (open/close)        |                                         | Objects 28 and 29 (1 bit)                                                                  |
| Presence of people in the room   |                                         | Objects 30 and 31 (1 bit)                                                                  |
| Card holder state (badge in/out) |                                         | Object 32 (1 bit)                                                                          |

**Table 2 - Input variables from internal sensors, physical inputs and standard communication objects**

The device does not have outputs for direct switching or control of heating / cooling terminals or for status or values signalling. The output variables include exclusively communication objects that are sent on the bus, received and processed by KNX actuators (general-purpose or dedicated to HVAC applications).

## 7 Application program for ETS

In the following chapters, the list of folders, parameters and communication objects of the application program is reported. Some specific functions of the thermostat are described in more detail in the dedicated paragraphs. The tree structure of the application program as imported into ETS (or by pressing the "Default Parameters" button of ETS) is as follows:



Other folders may appear depending on the choices done for the parameters of the folders represented in the main tree structure.

## 7.1 About EK-ET3-TP

The folder **About EK-ET3-TP** is for information purposes only and does not contain parameters to be set. The information given is:

© Copyright EKINEX S.p.A. 2019  
Application software for ETS4 & ETS5  
Version 1.00 (or later)  
KNX Multisensor T, RH and CO2eq with controller  
EKINEX S.p.A.  
Via Novara, 37  
I-28010 Vaprio d'Agogna (NO) Italy  
[www.ekinex.com](http://www.ekinex.com)  
[info@ekinex.com](mailto:info@ekinex.com)

## 7.2 General

The **General** folder includes the following parameters:

- Delay after bus voltage recovery
- Logic functions

The folder has no secondary folders.

### 7.2.1 Parameter and communication objects tables

| Parameter name                   | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Values                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Delay after bus voltage recovery |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>00:00:04.000 hh:mm:ss:fff</b><br>[range 00:00:04.000 ... 00:10:55.350] |
|                                  | <i>Time interval after which the transmission of the telegrams on the bus starts after the power supply is restored. The delay affects both the event-driven transmission and the cyclic transmission of a telegram. Regarding the latter, the counting of the pause interval for retransmission starts at the end of the time of initial delay.</i><br><i>The field has format hh:mm:ss:fff (hours : minutes : seconds .milliseconds): the default value 00:00:04.000 corresponds to 4 seconds.</i> |                                                                           |
| Logic functions                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Disabled / enabled</b>                                                 |

| Object name                                       | Conditions | Dim.   | Flags | DPT                   | Comm. Obj. No. |
|---------------------------------------------------|------------|--------|-------|-----------------------|----------------|
| Thermostat – HVAC mode out                        |            | 1 Byte | CR-T- | [20.102]<br>HVAC mode | 39             |
| Thermostat – HVAC manuale mode                    |            | 1 Bit  | CRWTU | [20.102]<br>HVAC mode | 40             |
| Thermostat – Building protection HVAC mode active |            | 1 Bit  | CR-T- | [1.011] state         | 41             |
| Thermostat – Chrono active status                 |            | 1 Bit  | CR-T- | [1.011] state         | 42             |

| Object name                         | Conditions | Dim.     | Flags | DPT                                  | Comm. Obj. No. |
|-------------------------------------|------------|----------|-------|--------------------------------------|----------------|
| Thermostat – Thermal generator lock |            | 1 Bit    | C-W-- | [1.005] alarm                        | 83             |
| Thermostat – Alarm text             |            | 14 Bytes | CR-T- | [16.000]<br>Character string (ASCII) | 85             |

## 7.3 Internal sensors

The **Internal sensors** folder includes the following parameters:

- Temperature sensor enabling
- Relative Humidity sensor enabling
- CO<sub>2</sub> equivalent sensor enabling

### 7.3.1 Temperature sensor

The **Temperature sensor** folder contains the following parameter:

- Filter type for the internata data computing
- Temperature offset, applied to the measured value
- Minimum change of value to send [K]
- Cyclic sending interval
- Threshold 1
- Threshold 2

#### 7.3.1.1 Parameter and communication objects tables

| Parameter name                      | Conditions                                                                                                                                                  | Values                                                            |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Temperature sensor                  |                                                                                                                                                             | <b>enabled</b><br>disabled                                        |
|                                     | <i>The temperature sensor is enabled as default.</i>                                                                                                        |                                                                   |
| Filter type                         | Temperature sensor = enabled                                                                                                                                | low<br><b>medium</b><br>high                                      |
|                                     | <i>Low = average value every 4 measurements</i><br><i>Medium = average value every 16 measurements</i><br><i>High = average value every 64 measurements</i> |                                                                   |
| Temperature offset                  | Temperature sensor = enabled                                                                                                                                | <b>0°C</b><br>[range -5°C ... +5°C]                               |
| Minimum change of value to send [K] | Temperature sensor = enabled                                                                                                                                | <b>0,5</b><br>[range 0 ... 5]                                     |
|                                     | <i>If the parameter is set to 0 (zero), no value is sent after a change.</i>                                                                                |                                                                   |
| Cyclic sending interval             | Temperature sensor = enabled                                                                                                                                | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |

| Parameter name                  | Conditions                                                                                   | Values                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Threshold 1                     | Temperature sensor = enabled                                                                 | <b>not active</b><br>below<br>above                               |
|                                 |                                                                                              |                                                                   |
| Value [°C]                      | Temperature sensor = enabled,<br>Threshold 1 = below or above                                | <b>7</b><br>[range 0 ... 50]                                      |
|                                 |                                                                                              |                                                                   |
| Threshold value update from bus | Temperature sensor = enabled,<br>Threshold 1 = below or above                                | <b>no</b> / yes                                                   |
|                                 |                                                                                              |                                                                   |
| Threshold lock enable           | Temperature sensor = enabled,<br>Threshold 1 = below or above                                | <b>no</b> / yes                                                   |
|                                 |                                                                                              |                                                                   |
| Behaviour at lock               | Temperature sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes | <b>none</b> / off / on                                            |
|                                 |                                                                                              |                                                                   |
| Behaviour at bus recovery       | Temperature sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes | <b>previous state</b> / lock / unlock                             |
|                                 |                                                                                              |                                                                   |
| Threshold 2                     | Temperature sensor = enabled                                                                 | <b>not active</b><br>below<br>above                               |
|                                 |                                                                                              |                                                                   |
| Value [°C]                      | Temperature sensor = enabled,<br>Threshold 2 = below or above                                | <b>45</b><br>[range 0 ... 50]                                     |
|                                 |                                                                                              |                                                                   |
| Threshold value update from bus | Temperature sensor = enabled,<br>Threshold 2 = below or above                                | <b>no</b> / yes                                                   |
|                                 |                                                                                              |                                                                   |
| Threshold lock enable           | Temperature sensor = enabled,<br>Threshold 2 = below or above                                | <b>no</b> / yes                                                   |
|                                 |                                                                                              |                                                                   |
| Behaviour at lock               | Temperature sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes | <b>none</b> / off / on                                            |
|                                 |                                                                                              |                                                                   |
| Behaviour at bus recovery       | Temperature sensor = enabled,<br>Threshold 2 = below or above<br>Threshold lock enable = yes | <b>previous state</b> / lock / unlock                             |
|                                 |                                                                                              |                                                                   |
| Hysteresis                      | Temperature sensor = enabled,<br>Threshold 1 and/or Threshold 2<br>= below or above          | <b>0,4 K</b><br>[other values between 0,2 K and 3 K]              |
|                                 |                                                                                              |                                                                   |
| Cyclic sending interval         | Temperature sensor = enabled,<br>Threshold 1 and/or Threshold 2<br>= below or above          | <b>no sending</b><br>[other values in the 30 s ... 120 min range] |
|                                 |                                                                                              |                                                                   |

| Object name                                | Conditions                                                                                             | Dim.    | Flags | DPT                      | Comm. Obj. No. |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------|---------|-------|--------------------------|----------------|
| Temperature value                          | Temperature sensor = enabled                                                                           | 2 Bytes | CR-T- | [9.001] temperature (°C) | 2              |
| Temperature threshold 1 - Switch           | Temperature sensor = enabled,<br>Threshold 1 = below or above                                          | 1 Bit   | CR-T- | [1.001] switch           | 3              |
| Temperature threshold 1 - Lock             | Temperature sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes           | 1 Bit   | C-W-- | [1.001] switch           | 4              |
| Temperature threshold 1 – Value (from bus) | Temperature sensor = enabled,<br>Threshold 1 = below or above<br>Threshold value update from bus = yes | 2 Bytes | C-W-- | [9.001] temperature (°C) | 5              |
| Temperature threshold 2 - Switch           | Temperature sensor = enabled,<br>Threshold 2 = below or above                                          | 1 Bit   | CR-T- | [1.001] switch           | 6              |
| Temperature threshold 2 - Lock             | Temperature sensor = enabled,<br>Threshold 2 = below or above<br>Threshold lock enable = yes           | 1 Bit   | C-W-- | [1.001] switch           | 7              |
| Temperature threshold 2 – Value (from bus) | Temperature sensor = enabled,<br>Threshold 2 = below or above<br>Threshold value update from bus = yes | 2 Bytes | C-W-- | [9.001] temperature (°C) | 8              |

## Acquisition filter

The acquisition filter calculates an average with a series of measured values before sending on the bus. The parameter can have the following values:

- low = average value every 4 measurements;
- medium = average value every 16 measurements;
- high = average value every 64 measurements.

## Correction of the measured temperature

The sampling of the temperature value occurs every 10 seconds, while the display is updated every minute. During the configuration with ETS the opportunity is given to correct the measured temperature value within the offset range of - 5 °C ... + 5 °C (step: 0.1 K).

### 7.3.2 Relative Humidity sensor

The **Relative humidity sensor** folder includes the following parameters:

- Filter type for the internata data computing
- Humidity offset, applied to the measured value
- Minimum change of value to send [%]
- Cyclic sending interval
- Threshold 1

- Threshold 2

## 7.3.2.1 Parameter and communication objects tables

| Parameter name                      | Conditions                                                                                                                                                  | Values                                                            |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Relative humidity sensor            |                                                                                                                                                             | enabled<br>disabled                                               |
|                                     | <i>The relative humidity sensor is disabled as default.</i>                                                                                                 |                                                                   |
| Filter type                         | Relative humidity sensor =<br>enabled                                                                                                                       | low<br><b>medium</b><br>high                                      |
|                                     | <i>Low = average value every 4 measurements</i><br><i>Medium = average value every 16 measurements</i><br><i>High = average value every 64 measurements</i> |                                                                   |
| Humidity offset                     | Relative humidity sensor =<br>enabled                                                                                                                       | <b>0 %</b><br>[range -10 % ... +10 %]                             |
|                                     |                                                                                                                                                             |                                                                   |
| Minimum change of value to send [%] | Relative humidity sensor =<br>enabled                                                                                                                       | <b>2</b><br>[range 0 % ... +10 %]                                 |
|                                     | <i>If the parameter is set to 0 (zero), no value is sent after a change.</i>                                                                                |                                                                   |
| Cyclic sending interval             | Relative humidity sensor =<br>enabled                                                                                                                       | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |
|                                     |                                                                                                                                                             |                                                                   |
| Threshold 1                         | Relative humidity sensor =<br>enabled                                                                                                                       | <b>not active</b><br>below<br>above                               |
|                                     |                                                                                                                                                             |                                                                   |
| Value [%]                           | Relative humidity sensor =<br>enabled,<br>Threshold 1 = below or above                                                                                      | <b>65</b><br>[range 0 ... 100]                                    |
|                                     |                                                                                                                                                             |                                                                   |
| Threshold value update from bus     | Relative humidity sensor =<br>enabled,<br>Threshold 1 = below or above                                                                                      | <b>no / yes</b>                                                   |
|                                     |                                                                                                                                                             |                                                                   |
| Threshold lock enable               | Relative humidity sensor =<br>enabled,<br>Threshold 1 = below or above                                                                                      | <b>no / yes</b>                                                   |
|                                     |                                                                                                                                                             |                                                                   |
| Behaviour at lock                   | Relative humidity sensor =<br>enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes                                                       | <b>none / off / on</b>                                            |
|                                     |                                                                                                                                                             |                                                                   |
| Behaviour at bus recovery           | Relative humidity sensor =<br>enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes                                                       | <b>previous state / lock / unlock</b>                             |
|                                     |                                                                                                                                                             |                                                                   |
| Threshold 2                         | Relative humidity sensor =<br>enabled                                                                                                                       | <b>not active</b><br>below<br>above                               |
|                                     |                                                                                                                                                             |                                                                   |

| Parameter name                  | Conditions                                                                                         | Values                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Value [%]                       | Relative humidity sensor = enabled,<br>Threshold 2 = below or above                                | <b>65</b><br>[range 0 ... 100]                                    |
| Threshold value update from bus | Relative humidity sensor = enabled,<br>Threshold 2 = below or above                                | <b>no</b> / yes                                                   |
| Threshold lock enable           | Relative humidity sensor = enabled,<br>Threshold 2 = below or above                                | <b>no</b> / yes                                                   |
| Behaviour at lock               | Relative humidity sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes | <b>none</b> / off / on                                            |
| Behaviour at bus recovery       | Relative humidity sensor = enabled,<br>Threshold 2 = below or above<br>Threshold lock enable = yes | <b>previous state</b> / lock / unlock                             |
| Hysteresis [%]                  | Relative humidity sensor = enabled,<br>Threshold 1 and/or Threshold 2 = below or above             | <b>3,0 %</b><br>[other values between 0,5 % and 4 %]              |
| Cyclic sending interval         | Relative humidity sensor = enabled,<br>Threshold 1 and/or Threshold 2 = below or above             | <b>no sending</b><br>[other values in the 30 s ... 120 min range] |

| Object name                                      | Conditions                                                                                                   | Dim.    | Flags | DPT                           | Comm. Obj. No. |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------|-------|-------------------------------|----------------|
| Humidity value (2 bytes)                         | Relative humidity sensor = enabled                                                                           | 2 Bytes | CR-T- | [9.007] humidity (%)          | 10             |
| Humidity value (1 byte)                          | Relative humidity sensor = enabled                                                                           | 1 Byte  | CR-T- | [5.001] percentage (0...100%) | 11             |
| Humidity threshold 1 - Switch                    | Relative humidity sensor = enabled,<br>Threshold 1 = below or above                                          | 1 Bit   | CR-T- | [1.001] switch                | 12             |
| Humidity threshold 1 - Lock                      | Relative humidity sensor = enabled,<br>Threshold 1 = below or above<br>Threshold lock enable = yes           | 1 Bit   | C-W-- | [1.001] switch                | 13             |
| Humidity threshold 1 – Value (2 bytes, from bus) | Relative humidity sensor = enabled,<br>Threshold 1 = below or above<br>Threshold value update from bus = yes | 2 Bytes | C-W-- | [9.001] temperature (°C)      | 14             |

| Object name                                      | Conditions                                                                                                   | Dim.    | Flags | DPT                           | Comm. Obj. No. |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------|-------|-------------------------------|----------------|
| Humidity threshold 1 – Value (1 byte, from bus)  | Relative humidity sensor = enabled,<br>Threshold 1 = below or above<br>Threshold value update from bus = yes | 1 Byte  | C-W-- | [5.001] percentage (0...100%) | 15             |
| Humidity threshold 2 - Switch                    | Relative humidity sensor = enabled,<br>Threshold 2 = below or above                                          | 1 Bit   | CR-T- | [1.001] switch                | 16             |
| Humidity threshold 2 - Lock                      | Relative humidity sensor = enabled,<br>Threshold 2 = below or above<br>Threshold lock enable = yes           | 1 Bit   | C-W-- | [1.001] switch                | 17             |
| Humidity threshold 2 – Value (2 bytes, from bus) | Relative humidity sensor = enabled,<br>Threshold 2 = below or above<br>Threshold value update from bus = yes | 2 Bytes | C-W-- | [9.001] temperature (°C)      | 18             |
| Humidity threshold 2 – Value (1 byte, from bus)  | Relative humidity sensor = enabled,<br>Threshold 2 = below or above<br>Threshold value update from bus = yes | 1 Byte  | C-W-- | [5.001] percentage (0...100%) | 19             |

## Acquisition filter

The acquisition filter computes an average with a series of measured values before sending on the bus. The parameter can have the following values:

- low = average value every 4 measurements;
- medium = average value every 16 measurements;
- high = average value every 64 measurements.

## Correction of the measured relative humidity

The sampling of the relative humidity value occurs every 10 seconds, while the display is updated every minute. During the configuration with ETS the opportunity is given to correct the measured relative humidity value within the offset range of – 10 % ... + 10 % (step: 1.0 %).

### 7.3.3 CO<sub>2</sub> sensor

The **CO<sub>2</sub> sensor** folder includes the following parameters:

- Filter type for the internata data computing
- CO<sub>2</sub> offset, applied to the measured value
- Minimum change of value to send [%]
- Cyclic sending interval
- CO<sub>2</sub> function

## 7.3.3.1 Parameter and communication objects tables

| Parameter name                        | Conditions                                                                                                                                                  | Values                                                            |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| CO <sub>2</sub> sensor                |                                                                                                                                                             | enabled<br>disabled                                               |
|                                       | <i>The CO<sub>2</sub> sensor is enabled as default.</i>                                                                                                     |                                                                   |
| Filter type                           | CO <sub>2</sub> sensor = enabled                                                                                                                            | low<br><b>medium</b><br>high                                      |
|                                       | <i>Low = average value every 4 measurements</i><br><i>Medium = average value every 16 measurements</i><br><i>High = average value every 64 measurements</i> |                                                                   |
| CO <sub>2</sub> offset                | CO <sub>2</sub> sensor = enabled                                                                                                                            | <b>0 %</b><br>[range -10 % ... +10 %]                             |
|                                       |                                                                                                                                                             |                                                                   |
| Minimum change of value to send [ppm] | CO <sub>2</sub> sensor = enabled                                                                                                                            | <b>0 ppm</b><br>[range -400 ppm ... +400 ppm]                     |
|                                       | <i>If the parameter is set to 0 (zero), no value is sent after a change.</i>                                                                                |                                                                   |
| Cyclic sending interval               | CO <sub>2</sub> sensor = enabled                                                                                                                            | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |
|                                       |                                                                                                                                                             |                                                                   |
| CO <sub>2</sub> function              | CO <sub>2</sub> sensor = enabled                                                                                                                            | disabled<br><b>enabled</b>                                        |
|                                       | <i>It enables the "CO<sub>2</sub> control" folder.</i>                                                                                                      |                                                                   |

| Object name           | Conditions                       | Dim.    | Flags | DPT                            | Comm. Obj. No. |
|-----------------------|----------------------------------|---------|-------|--------------------------------|----------------|
| CO <sub>2</sub> value | CO <sub>2</sub> sensor = enabled | 2 Bytes | CR-T- | [9.008]<br>parts/million (ppm) | 9              |
|                       |                                  |         |       |                                |                |

### Acquisition filter

The acquisition filter computes an average with a series of measured values before sending on the bus. The parameter can have the following values:

- low = average value every 4 measurements;
- medium = average value every 16 measurements;
- high = average value every 64 measurements.

### Correction of the measured relative humidity

The sampling of the CO<sub>2</sub> equivalent value occurs every 10 seconds, while the display is updated every minute. During the configuration with ETS the opportunity is given to correct the measured relative humidity value within the offset range of – 400 ppm ... + 400 ppm (step: 50 ppm).

## 7.4 External sensors (from bus)

As “external sensors” are intended KNX-devices (or conventional sensors interfaced to the bus through KNX devices) which send states or values to the Multisensor controller via the bus. Enabling an external sensor, without connecting the corresponding communication object, generates a permanent alarm on the display and suspends the thermoregulation function.

The folder **External sensors (from bus)** includes the following parameters:

- Room temperature
- Relative humidity
- Antistratification temperature
- Outdoor temperature
- Coil temperature
- Floor surface temperature
- Flow temperature
- Analog sensors timeout
- Anticondensation
- Window contact X (X = 1, 2)
- Presence sensor X (X = 1, 2)
- Card holder contact
- Digital sensors timeout

### 7.4.1 Parameter and communication object tables

| Parameter name                 | Conditions                                                                                                                                                                                                                                  | Values                                                            |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Room temperature               |                                                                                                                                                                                                                                             | <b>disabled</b> / enabled                                         |
|                                | <i>It enables a bus temperature sensor. The measured value can be used to calculate a weighted average value in combination with the temperature sensor integrated into the device or a temperature sensor connected to a device input.</i> |                                                                   |
| Cyclic reading interval        | Room temperature = enabled                                                                                                                                                                                                                  | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                                | <i>If the parameter is set to “no reading”, the corresponding communication object must be updated by the remote device sending data. With any different value, data are updated with a reading request by the room thermostat.</i>         |                                                                   |
| Relative humidity              |                                                                                                                                                                                                                                             | <b>disabled</b> / enabled                                         |
|                                |                                                                                                                                                                                                                                             |                                                                   |
| Humidity CO dimension          | Relative humidity = enabled                                                                                                                                                                                                                 | 1 byte (DPT 5.001)<br><b>2 byte (DPT 9.007)</b>                   |
|                                |                                                                                                                                                                                                                                             |                                                                   |
| Cyclic reading interval        | Relative humidity = enabled                                                                                                                                                                                                                 | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                                |                                                                                                                                                                                                                                             |                                                                   |
| Antistratification temperature |                                                                                                                                                                                                                                             | <b>disabled</b> / enabled                                         |
|                                | <i>It enables a temperature bus sensor to carry out the antistratification function.</i>                                                                                                                                                    |                                                                   |
| Cyclic reading interval        | Antistratification temperature = enabled                                                                                                                                                                                                    | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                                |                                                                                                                                                                                                                                             |                                                                   |

|                           |                                                                                                                                                                                                                                                                              |                                                                   |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Outdoor temperature       |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables an outdoor temperature bus sensor.</i>                                                                                                                                                                                                                         |                                                                   |
| Cyclic reading interval   | Light sensor = enabled                                                                                                                                                                                                                                                       | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
| Coil temperature          |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables a bus sensor for measuring the coil temperature of the conveying fluid for heat exchange. The acquisition of the value allows realizing the hot-start function of a fan.</i>                                                                                   |                                                                   |
| Cyclic reading interval   | Coil temperature = enabled                                                                                                                                                                                                                                                   | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
| Floor surface temperature |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables a bus sensor for measuring the surface temperature of a floor heating system. The acquisition of the value allows to realize the function of surface temperature limitation.</i>                                                                               |                                                                   |
| Cyclic reading interval   | Floor surface temperature = enabled                                                                                                                                                                                                                                          | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
| Flow temperature          |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables a bus sensor for measuring the flow temperature of the conveying fluid. The acquisition of the value allows calculating the dew-point temperature to realize the active anticondensation protection function in surface cooling plants (floor or ceiling).</i> |                                                                   |
| Cyclic reading interval   | Flow temperature = enabled                                                                                                                                                                                                                                                   | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
| Analog sensors timeout    |                                                                                                                                                                                                                                                                              | <b>00:05:00hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15]          |
|                           | <i>The field has format hh:mm:ss (hours : minutes : seconds): the default value 00:05:00 corresponds to a timeout of 5 minutes. The value 00:00:00 means that the timeout of the analogic sensors is disabled.</i>                                                           |                                                                   |
| Anticondensation          |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables a bus sensor for detecting the condensation.</i>                                                                                                                                                                                                               |                                                                   |
| Signal                    | Anticondensation = enabled                                                                                                                                                                                                                                                   | <b>not inverted / inverted</b>                                    |
| Cyclic reading interval   | Anticondensation = enabled                                                                                                                                                                                                                                                   | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
| Window contact 1          |                                                                                                                                                                                                                                                                              | <b>disabled / enabled</b>                                         |
|                           | <i>It enables a bus sensor for detecting the state of opening / closing of a window or a door.</i>                                                                                                                                                                           |                                                                   |
| Signal                    | Window contact 1= enabled                                                                                                                                                                                                                                                    | <b>not inverted / inverted</b>                                    |
| Cyclic reading interval   | Window contact 1= enabled                                                                                                                                                                                                                                                    | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |

|                         |                                                                                                                                                                                                                   |                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Window contact 2        |                                                                                                                                                                                                                   | <b>disabled</b> / enabled                                         |
|                         | <i>It enables a bus sensor for detecting the state of opening / closing of a window or a door.</i>                                                                                                                |                                                                   |
| Signal                  | Window contact 2= enabled                                                                                                                                                                                         | <b>not inverted</b> / inverted                                    |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Cyclic reading interval | Window contact 2= enabled                                                                                                                                                                                         | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Presence sensor 1       |                                                                                                                                                                                                                   | <b>disabled</b> / enabled                                         |
|                         | <i>It enables a bus sensor for detecting the presence / absence of people within a room.</i>                                                                                                                      |                                                                   |
| Signal                  | Presence sensor 1 = enabled                                                                                                                                                                                       | <b>not inverted</b> / inverted                                    |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Cyclic reading interval | Presence sensor 1 = enabled                                                                                                                                                                                       | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Presence sensor 2       |                                                                                                                                                                                                                   | <b>disabled</b> / enabled                                         |
|                         | <i>It enables a bus sensor for detecting the presence / absence of people within a room.</i>                                                                                                                      |                                                                   |
| Signal                  | Presence sensor 2= enabled                                                                                                                                                                                        | <b>not inverted</b> / inverted                                    |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Cyclic reading interval | Presence sensor 2= enabled                                                                                                                                                                                        | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Card holder contact     |                                                                                                                                                                                                                   | <b>disabled</b> / enabled                                         |
|                         | <i>It enables a bus sensor for detecting the presence / absence of people in a hotel room provided with a card holder.</i>                                                                                        |                                                                   |
| Signal                  | Card holder contact = enabled                                                                                                                                                                                     | <b>not inverted</b> / inverted                                    |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Cyclic reading interval | Card holder contact = enabled                                                                                                                                                                                     | <b>no reading</b><br>[other values in the range 30 s ... 120 min] |
|                         |                                                                                                                                                                                                                   |                                                                   |
| Digital sensors timeout |                                                                                                                                                                                                                   | <b>00:05:00hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15]          |
|                         | <i>The field has format hh:mm:ss (hours : minutes : seconds): the default value 00:05:00 corresponds to a timeout of 5 minutes. The value 00:00:00 means that the timeout of the digital sensors is disabled.</i> |                                                                   |

| Object name                  | Conditions                                                             | Dim.   | Flags | DPT                         | Comm. Obj. No. |
|------------------------------|------------------------------------------------------------------------|--------|-------|-----------------------------|----------------|
| Room temperature (from bus)  | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature (°C) | 20             |
|                              |                                                                        |        |       |                             |                |
| Humidity (2 bytes, from bus) | Relative humidity sensor = enabled,<br>Humidity CO dimension = 2 bytes | 2 Byte | C-WTU | [9.007]<br>humidity (%)     | 21             |
|                              |                                                                        |        |       |                             |                |

| Object name                               | Conditions                                                             | Dim.   | Flags | DPT                                | Comm. Obj. No. |
|-------------------------------------------|------------------------------------------------------------------------|--------|-------|------------------------------------|----------------|
| Humidity (1 byte, from bus)               | Relative humidity sensor = enabled,<br>Humidity CO dimension = 1 bytes | 1 Byte | C-WTU | [5.001]<br>percentage<br>(0..100%) | 22             |
| Antistratification temperature (from bus) | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature<br>(°C)     | 23             |
| Outdoor temperature (from bus)            | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature °C          | 24             |
| Coil temperature (from bus)               | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature<br>(°C)     | 25             |
| Floor temperature (from bus)              | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature<br>(°C)     | 26             |
| Flow temperature (from bus)               | enabled                                                                | 2 Byte | C-WTU | [9.001]<br>temperature<br>(°C)     | 27             |
| Anticondensation (from bus)               | enabled                                                                | 1 Bit  | C-WTU | [1.001] switch                     | 33             |
| Windows contact sensor 1 (from bus)       | enabled                                                                | 1 Bit  | C-WTU | [1.019]<br>window/door             | 28             |
| Windows contact sensor 2 (from bus)       | enabled                                                                | 1 Bit  | C-WTU | [1.019]<br>window/door             | 29             |
| Presence sensor 1 (from bus)              | enabled                                                                | 1 Bit  | C-WTU | [1.018]<br>occupancy               | 30             |
| Presence sensor 2 (from bus)              | enabled                                                                | 1 Bit  | C-WTU | [1.018]<br>occupancy               | 31             |
| Contact of card holder (from bus)         | enabled                                                                | 1 Bit  | C-WTU | [1.018]<br>occupancy               | 32             |

## About sensor timeout

The internal control system of the thermostat cyclically monitors the updating status of the values of the external sensors (from bus) and the inputs when the timeout setting expires. In case no updated value has been received, the regulation function is suspended, an alarm is displayed on the display through the symbol and the corresponding alarm code (see also the list of alarms in the Diagnostics paragraph).

## 7.5 Weighted temperature value

The **Weighted temperature value** folder appears only if two sensors for measuring the room temperature are enabled and includes the following parameters:

- Relative weight
- Minimum change of value to send [K]
- Cyclic sending interval

### 7.5.1 Parameter and communication object tables

| Parameter name                      | Conditions                                                           | Values                                                                                                                                                                            |
|-------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relative weight                     |                                                                      | 100% main sensor<br>90% / 10%<br>80% / 20%<br>70% / 30%<br>60% / 40%<br><b>50% / 50%</b><br>40% / 60%<br>30% / 70%<br>20% / 80%<br>10% / 90%<br>100% additional sensor (from bus) |
| Minimum change of value to send [K] |                                                                      | <b>0,5</b><br>[other values in the range 0 ... 5 K]                                                                                                                               |
|                                     | If the parameter is set to 0 (zero), no value is sent at the change. |                                                                                                                                                                                   |
| Cyclic sending interval             |                                                                      | <b>no sending</b><br>[other values in the range 30 s ... 120 min]                                                                                                                 |

| Object name          | Conditions                                                                                                  | Dim.   | Flags | DPT                       | Comm. Obj. No. |
|----------------------|-------------------------------------------------------------------------------------------------------------|--------|-------|---------------------------|----------------|
| Weighted temperature | Internal sensors – temperature sensor = enabled<br>External sensors (from bus) – Room temperature = enabled | 2 Byte | CR-T- | [9.001]<br>temperature °C | 34             |

### About weighted temperature

The device allows the acquisition of the room temperature in two ways:

- 1) from the temperature sensor integrated in the device;
- 2) via bus from another KNX device, e.g. from an ekinex pushbutton (External sensors (from bus) ⇒ Room temperature = enabled);

To optimize or correct the room temperature regulation in special cases (in large rooms, in presence of strong asymmetry of the temperature distribution, when the installation of the device is in a position not suitable, etc.), the device can then use a weighted average between two temperature values. The weights are assigned by the parameter *Relative weight* that assigns a ratio of the two values.

## 7.6 LED

The **LED** folder allows to set the following parameters:

- LEDs intensity from bus
- LED L1 and L2 (temperature control)
- LED L3 and L4 (humidity control)
- LED L5, L6, L7 and L8 (CO<sub>2</sub> control)
- Technical alarm

### 7.6.1 Parameters

| Parameter name                                  | Conditions                                                                                                                                                                                    | Values                             |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| LEDs intensity from bus                         |                                                                                                                                                                                               | no / yes                           |
| LEDs intensity                                  | LEDs intensity from bus = no                                                                                                                                                                  | 50 %<br>0% ... 100% with step 10 % |
|                                                 | <i>This parameter sets the intensity for ALL the signalling LEDs.</i>                                                                                                                         |                                    |
| LED L1 and L2 (temperature control)             |                                                                                                                                                                                               | disabled / <b>enabled</b>          |
|                                                 | <i>If disabled, the LEDs are always off.</i>                                                                                                                                                  |                                    |
| LED L3 and L4 (humidity control)                |                                                                                                                                                                                               | disabled / <b>enabled</b>          |
|                                                 | <i>If disabled, the LEDs are always off.</i>                                                                                                                                                  |                                    |
| LED L5, L6, L7 and L8 (CO <sub>2</sub> control) |                                                                                                                                                                                               | disabled / <b>enabled</b>          |
|                                                 | <i>If disabled, the LEDs are always off.</i>                                                                                                                                                  |                                    |
| Technical alarm                                 |                                                                                                                                                                                               | <b>disabled</b> / enabled          |
|                                                 | <i>It enables the communication object nr. 0 "Technical alarm" that allows to activate an alarm signal via a bus telegram. The flashing led indicates that the alarm condition is active.</i> |                                    |

| Object name               | Conditions                    | Dim.   | Flags | DPT                             | Comm. Obj. No. |
|---------------------------|-------------------------------|--------|-------|---------------------------------|----------------|
| Technical alarm           | Technical alarm = enabled     | 1 Bit  | C-W-- | [1.005] alarm                   | 0              |
| LEDs intensity percentage | LEDs intensity from bus = yes | 1 Byte | C-W-- | [5.001] percentage<br>(0..100%) | 1              |

## 7.7 Temperature control

The **Temperature control** folder includes the following secondary folders:

- Settings
- Heating
- Cooling
- Ventilation

The **Cooling** and **Ventilation** secondary folders appear only if in the **Settings** folder the parameter “Thermostat function” is set to either the value *both heating and cooling* or *cooling*.

### 7.7.1 Settings

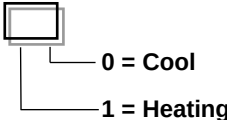
The **Settings** folder includes the following parameters:

- Setpoint type
- Thermostat function
- Command Communication Object unique or separated (2 or 4-pipes systems)
- Heating – cooling cyclic sending interval
- HVAC mode after download
- Setpoint cyclic sending interval
- End of manual operation
- Disable temperature controller from bus
- Transmission delay after mode change
- Valve protection function

#### 7.7.1.1 Parameter and communication object tables

| Parameter name                          | Conditions                                     | Values                                                            |
|-----------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| Setpoint type                           |                                                | <b>single</b> / absolute / relative                               |
| Thermostat function                     |                                                | <b>heating</b><br>cooling<br>both heating and cooling             |
| Command Communication Object            | Thermostat function = both heating and cooling | <b>separated</b> / unique                                         |
| Heating-cooling cyclic sending interval | Thermostat function = both heating and cooling | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |

| Parameter name                          | Conditions                                                                                                                                                                                                                                                                                                                                                                                   | Values                                                                             |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| HVAC mode after download                | Thermostat function = both heating and cooling                                                                                                                                                                                                                                                                                                                                               | <b>no change</b><br>heating<br>cooling                                             |
| Setpoint cyclic sending interval        |                                                                                                                                                                                                                                                                                                                                                                                              | <b>no sending</b><br>[other values in the range 30 s ... 120 min]                  |
|                                         | <i>The setpoint value that can be sent cyclically is the actual one, depending on the operating mode set manually by the user or automatically by another KNX supervising device with the possibility of time scheduling. The actual setpoint value takes also into account the actual state of the contacts window and presence detection (if the corresponding functions are enabled).</i> |                                                                                    |
| End of manual operation                 |                                                                                                                                                                                                                                                                                                                                                                                              | <b>till first telegram from bus</b><br>[other values in the range 30 min ... 48 h] |
| Disable temperature controller from bus |                                                                                                                                                                                                                                                                                                                                                                                              | <b>no / yes</b>                                                                    |
|                                         | <i>It defines the possibility to disable the temperature controller function via bus.</i>                                                                                                                                                                                                                                                                                                    |                                                                                    |
| Signal from bus                         | Disable temperature controller from bus = yes                                                                                                                                                                                                                                                                                                                                                | <b>not inverted</b> / inverted                                                     |
|                                         | <i>It defines the logic for the signal that enables or disabled the temperature controller function via bus.</i>                                                                                                                                                                                                                                                                             |                                                                                    |
| Transmission delay after mode change    |                                                                                                                                                                                                                                                                                                                                                                                              | <b>00:00:04.000</b> (hh:mm:ss)<br>(range 00:00:00.000 – 00:10:55.350)              |
| Valve protection function               |                                                                                                                                                                                                                                                                                                                                                                                              | <b>disabled</b> / enabled                                                          |
|                                         | <i>It enables the function that activates the drive for the valve control during periods of inactivity of the system.</i>                                                                                                                                                                                                                                                                    |                                                                                    |
| Frequency                               | Valve protection function = enabled                                                                                                                                                                                                                                                                                                                                                          | once a day<br><b>once a week</b><br>once a month                                   |
| Time interval                           | Valve protection function = enabled                                                                                                                                                                                                                                                                                                                                                          | <b>10 s</b><br>[other values in the range 5 s ... 20 min]                          |

| Object name                | Conditions                                                                                                                                                                                                                                                                                                                                                                                    | Dim.   | Flags | DPT                      | Comm. Obj. No. |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--------------------------|----------------|
| Actual setpoint            |                                                                                                                                                                                                                                                                                                                                                                                               | 2 Byte | CR-T- | [9.001] temperature (°C) | 43             |
| Manual setpoint            | Setpoint type = absolute or relative                                                                                                                                                                                                                                                                                                                                                          | 2 Byte | C-W-- | [9.001] temperature (°C) | 44             |
| Heating/cooling status out | Always visible                                                                                                                                                                                                                                                                                                                                                                                | 1 Bit  | CR-T- | [1.100] heating/cooling  | 35             |
|                            | <p><i>The communication object is updated on the bus on event of change internally elaborated by the controller. The object is always available and contains the information about the current conduction mode of the internal temperature controller.</i></p> <p><b>[1.100] DPT Heat/Cool 1 Bit</b></p>  |        |       |                          |                |

| Object name                                                                                                                                                                                                                                                                                                                              | Conditions                                                                                 | Dim.   | Flags | DPT                      | Comm. Obj. No. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------|-------|--------------------------|----------------|
| Heating/cooling status in                                                                                                                                                                                                                                                                                                                | Thermostat function = both heating and cooling;<br>Heating – cooling switchover = from bus | 1 Bit  | C-W-- | [1.100] heating/cooling  | 36             |
| <i>The communication object is received by the bus. On switching event, internal controllers of primary and auxiliary stage (if enabled) switch their operating mode.</i>                                                                                                                                                                |                                                                                            |        |       |                          |                |
| HVAC mode in                                                                                                                                                                                                                                                                                                                             |                                                                                            | 1 Byte | C-W-- | [20.102] HVAC mode       | 37             |
| <i>The device receives the operating mode (HVAC mode) from a bus device with function of supervisor. The operating mode received through this communication object can be later modified by the user (in this case the room thermostat switches to manual mode).</i>                                                                     |                                                                                            |        |       |                          |                |
| HVAC forced mode in                                                                                                                                                                                                                                                                                                                      |                                                                                            | 1 Byte | C-W-- | [20.102] HVAC mode       | 38             |
| <i>The communication object allows to receive the operating mode same way as “HVAC mode in” communication object, except the operating mode received through this object (apart from AUTO command) can no longer be modified by user. The user can modify the operating mode only after “HVAC forced mode in” has sent AUTO command.</i> |                                                                                            |        |       |                          |                |
| HVAC mode out                                                                                                                                                                                                                                                                                                                            |                                                                                            | 1 Byte | CR-T- | [20.102] HVAC mode       | 39             |
| HVAC manual mode                                                                                                                                                                                                                                                                                                                         |                                                                                            | 1 Byte | CRWTU | [20.102] HVAC mode       | 40             |
| Chrono active status                                                                                                                                                                                                                                                                                                                     |                                                                                            | 1 Bit  | CR-T- | [1.011] state            | 42             |
| Manual setpoint status                                                                                                                                                                                                                                                                                                                   | Setpoint type = absolute or relative                                                       | 1 Bit  | CRWTU | [1.011] state            | 45             |
| Setpoint in                                                                                                                                                                                                                                                                                                                              | Setpoint type = single                                                                     | 2 Byte | CRWTU | [9.001] temperature (°C) | 46             |
| Building protection HVAC mode active                                                                                                                                                                                                                                                                                                     |                                                                                            | 1 Bit  | CR-T- | [1.011] state            | 41             |

### About heating/cooling terminals

The application functions of the room temperature controller configurable with ETS are particularly suitable for the control through general-purpose or dedicated KNX actuators of the following heating/cooling terminals:

- radiators;
- electric heaters;
- fancoils;
- radiant panels;
- dehumidification units;
- radiant panels + radiators (as auxiliary system);
- radiant panels + fancoils (as auxiliary system);
- radiant panels + dehumidification units.

#### 7.7.1.2 Heating/cooling switchover

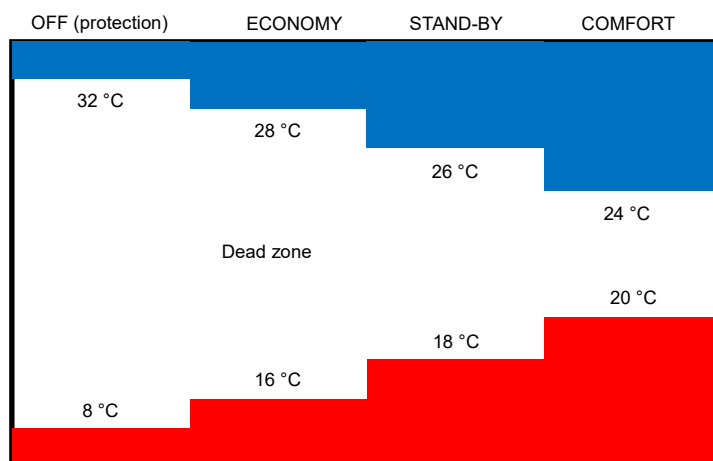
The switchover between the two seasonal modes (heating / cooling) may happens as follows:

- 1) automatically by the device;
- 2) from the KNX bus through a dedicated communication object.

## Automatic switch-over (mode 1)

The automatic switch-over is suitable for a 4-pipe hydraulic configuration of the heating/cooling installation (used e.g. for fan-coil units or ceiling radiant panels). Also in this case the information can be sent on the bus with the output communication object [DPT 1.100 heat/cool]; the difference from the first mode is that switching is performed automatically on the basis of a comparison between the values of the actual temperature and the setpoint temperature. In this mode, the manual switching by the user is disabled.

The automatic switch-over is realised with the introduction of a neutral zone according to the scheme shown in Picture 7.



Picture 7 - Neutral zone and example of setpoint values correctly distributed

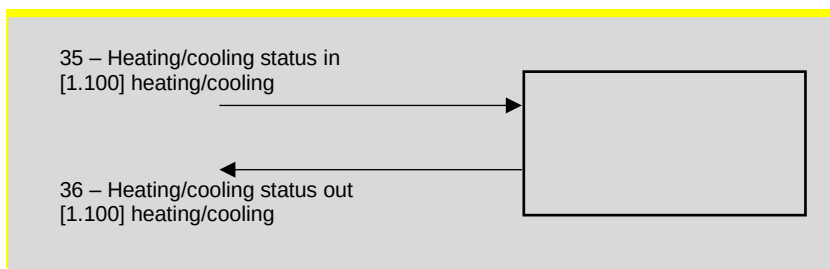
Until the actual (measured) temperature is located below the setpoint value for the heating, the operation is heating; in the same way, if the actual value (measured) is greater than the setpoint value for the cooling, the mode is cooling. If the actual value (measured) temperature is within the dead zone, the previous mode of operation remains active; the switching point of the operation mode for heating / cooling must take place in correspondence with the current setpoint for the active HVAC, in the same way the switching cooling / heating must take place at the setpoint for heating.

## Switch-over via KNX bus (mode 3)

The switch-over from the bus requires that the command is received from another KNX device, e.g. another room temperature controller or a Touch&See unit configured to this purpose. The other device works in this way as a “supervisor” device: the switch-over is triggered by the input communication object [DPT 1.100 heat/cool]. In this mode the manual switch-over by an enduser is disabled. Thanks to this mode, the supervising device is able to control the “slave” devices with time-scheduled programs, extending their functionality to that of a chronothermostat (centrally controlled by the supervising device).

The communication objects indicated in the block diagram allows monitoring and modifying the current conduction mode forced on the temperature controller. The object 35 – *Heating/cooling status out* is always available, even when the thermostat function is set on heating or cooling only. When the function is set on *both heating and cooling*, the cyclic sending on bus can be enabled; anyway, the information about the actual conduction mode can be acquired with a reading request to this communication object.

The object 36 – *Heating/cooling status in* is exposed only when the function is both heating and cooling and the switching among the different modes is performed by the bus.



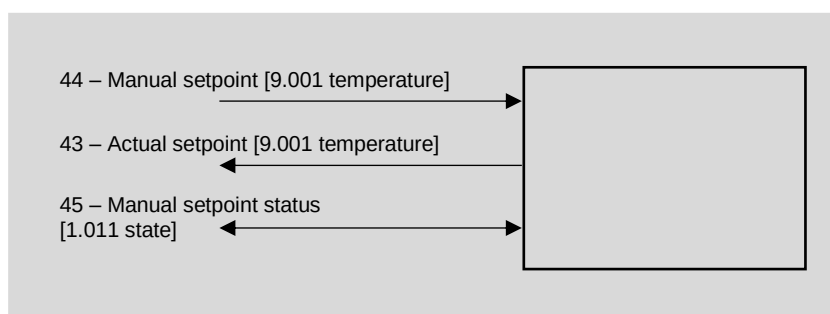
Picture 8

### 7.7.1.3 Valve protection function

The function is suitable for heating and cooling systems that use water as thermal conveying fluid and are provided with motorized valves for the interception of a zone or of a single room. Long periods of inactivity of the system can lead to the blockage of valves: to prevent this, the room temperature controller may periodically send a command to open / close the valve in the period of inactivity of the system. This possibility is made available in the application program by means of the parameter "Valve protection function", further defined by the frequency and duration of the valve control.

### 7.7.1.4 Remote Setpoint modification

The communication objects shown in Picture 9 allow to monitor the Setpoint forced modifications performed locally by the user when interacting with the LCD display and the touch buttons of the room thermostat. The communication objects (from now on: C.O.) also allow to perform the same modifications remotely, for example from a supervisor software.



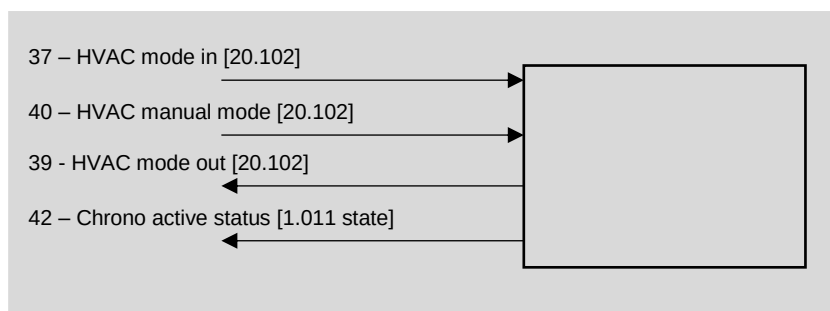
Picture 9

Those objects are about the Setpoint forced modification: alternatively, the supervisor can act directly on the operating mode setpoints (C.O. with index from 46 to 53). The value of the C.O. 43 - *Actual setpoint* represents the current operative setpoint which the control algorithms are based on. The C.O. 45 – *Manual setpoint status* indicates (read request mode) if the forced mode is active. The supervisor can force at any time the actual setpoint by writing a new value directly into the C.O. 44 – *Manual setpoint*. The C.O. 45 – *Manual setpoint status* can also be used in writing to exit the active forced mode.

### 7.7.1.5 Remote operative mode modification

The communication objects shown in figure allow to monitor the operating mode (comfort, standby, economy and building protection) modifications performed in manual or forced mode, or the operating mode forced by

chrono program. The communication objects (from now on: C.O.) also allow to perform the same modifications remotely, for example from a supervisor software.



The C.O. 37 – *HVAC mode in* is associated to the chrono program. The C.O.s 39 – *HVAC mode out* and 42 – *HVAC chrono active status* allow the remote supervisor to discern the operating mode currently active on the room thermostat and also allow to understand if the chrono program is active or if attenuation is handled manually or not. The supervisor can set at any time a manual operating mode through C.O. 40 – *HVAC manual mode*; to start the chrono program remotely, the C.O. 40 – *HVAC manual mode* is to be set on value 0 = Automatic.

## 7.7.2 Heating

The **Heating** folder includes the following parameters:

- Temperature setpoint [°C]
- Comfort temp. setpoint [°C]
- Standby temperature setpoint [°C]
- Economy temp. setpoint [°C]
- Standby temperature offset [0,1 K]
- Economy temperature offset [0,1 K]
- Building protection temp. setpoint [°C]
- Heating type
- Control type
- Hysteresis
- Cyclic sending interval
- Min. change of value to send [%]
- PWM cycle time
- Proportional band [0,1 K]
- Integral time [min]
- Min. control value [%]
- Max. control value [%]
- Floor temperature limitation
- Temperature limit [°C]
- Hysteresis [K]
- Auxiliary heating
- Communication object
- Disabled from bus
- Offset from setpoint
- Hysteresis
- Cyclic sending interval
- Ventilation for auxiliary heating

### 7.7.2.1 Parameter and communication object tables

Conditions: *Settings* ⇒ Thermostat function = heating or both heating and cooling.

| Parameter name                                                                                                   | Conditions                           | Values                         |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------|
| Temperature setpoint [°C]                                                                                        | Setpoint type = single               | <b>21</b><br>[range 10 ... 50] |
| Comfort temp. setpoint [°C]                                                                                      | Setpoint type = absolute or relative | <b>21</b><br>[range 10 ... 50] |
| Standby temp. setpoint [°C]                                                                                      | Setpoint type = absolute             | <b>18</b><br>[range 10 ... 50] |
| For a correct operation of the device the standby temperature setpoint has to be < comfort temperature setpoint. |                                      |                                |

| Parameter name                          | Conditions                                                                                                                                                                                              | Values                                                                                      |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Economy temp. setpoint [°C]             | Setpoint type = absolute                                                                                                                                                                                | <b>16</b><br>[range 10 ... 50]                                                              |
|                                         | <i>For a correct operation of the device the economy temperature setpoint has to be &lt; standby temperature setpoint.</i>                                                                              |                                                                                             |
| Standby temperature offset [0,1 K]      | Setpoint type = relative                                                                                                                                                                                | <b>-30</b><br>[range -80 ... -10]                                                           |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| Economy temperature offset [0,1 K]      | Setpoint type = relative                                                                                                                                                                                | <b>-50</b><br>[range -80 ... -10]                                                           |
|                                         | <i>For a correct operation of the device the economy temperature offset has to be &lt; standby temperature offset.</i>                                                                                  |                                                                                             |
| Building protection temp. setpoint [°C] |                                                                                                                                                                                                         | <b>7</b><br>[range 2 ... 10]                                                                |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| Heating type                            |                                                                                                                                                                                                         | <b>radiators</b><br>electric<br>fan-coils<br>floor radiant panels<br>ceiling radiant panels |
|                                         | <i>It defines the terminal used for the thermal exchange in the room. The choice affects the parameters of the PWM control algorithm (Proportional band and Integral time) and the control options.</i> |                                                                                             |
| Control type                            |                                                                                                                                                                                                         | <b>2 point hysteresis</b><br>PWM (pulse width modulation)<br>continuous                     |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| Hysteresis                              | Control type = 2 point hysteresis                                                                                                                                                                       | <b>0,3 K</b><br>[other values in the range 0,2 K ... 3 K]                                   |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| Hysteresis position                     | Heating type = floor radiant panels,<br>ceiling radiant panels,<br>Control type = 2 point hysteresis                                                                                                    | <b>below / above</b>                                                                        |
|                                         | <i>The above hysteresis is suitable in case of special applications requiring mixing group control.</i>                                                                                                 |                                                                                             |
| Cyclic sending interval                 | Control type = 2 point hysteresis,<br>continuous                                                                                                                                                        | <b>no sending</b><br>[other values in the range 30 s ... 120 min]                           |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| Min. change of value to send [%]        | Control type = continuous                                                                                                                                                                               | <b>10</b><br>[range 0 ... 100]                                                              |
|                                         |                                                                                                                                                                                                         |                                                                                             |
| PWM cycle time                          | Control type = PWM                                                                                                                                                                                      | <b>15 min</b><br>[range 5 ... 240 min]                                                      |
|                                         |                                                                                                                                                                                                         |                                                                                             |

| Parameter name               | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Values                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Proportional band [0,1 K]    | Control type = continuous or PWM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>40</b><br>[range 5 ... 100]                            |
|                              | <p>The value is in tenths of Kelvin (K) degree.</p> <p>*) The field contains a preset value that depend on the selected heating type (the value can be modified):</p> <ul style="list-style-type: none"> <li>radiators: 50 ( 5 K)</li> <li>electric: 40 (4 K)</li> <li>fan-coils: 40 (4 K)</li> <li>floor radiant panels: 50 (5 K)</li> <li>ceiling radiant panels: 50 (5 K)</li> </ul> <p>The value of the parameter Proportional band represents the max difference between the setpoint temperature and the measured temperature that causes the max control output.</p>                      |                                                           |
| Integral time [min]          | Control type = continuous or PWM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>90</b><br>[other values in the range 0 ... 255 min]    |
|                              | <p>*) The field contains a preset value that depend on the selected heating type (the value can be modified):</p> <ul style="list-style-type: none"> <li>radiators: 150 min</li> <li>electric: 100 min</li> <li>fan-coils: 90 min</li> <li>floor radiant panels: 240 min</li> <li>ceiling radiant panels: 180 min</li> </ul>                                                                                                                                                                                                                                                                     |                                                           |
| Min control value [%]        | Control type = continuous or PWM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>15</b> [range 0 ... 30]                                |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                           |
| Max control value [%]        | Control type = continuous or PWM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>85</b> [range 70 ... 100]                              |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                           |
| Floor temperature limitation | Heating type = floor radiant panels,<br>External sensors (from bus) ⇒ Floor surface temperature sensor = enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>disabled / enabled</b>                                 |
|                              | <p>This parameter enables the floor temperature limitation of a floor radiant panel. It is mandatory to measure the floor surface temperature by enabling the corresponding temperature sensor in "External sensors (from bus)" folder.</p> <p><b>Important!</b> This function does not replace the overtemperature protection usually installed in hydronic floor systems, realized with the proper safety thermostat.</p>                                                                                                                                                                      |                                                           |
| Temperature limit [°C]       | Floor temperature limitation = enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>29</b><br>[range 20 ... 40]                            |
|                              | <p>According to EN 1264 a maximum allowed temperature is prescribed for the surface of a floor heating system:</p> <ul style="list-style-type: none"> <li><math>T(\text{sup}) \text{ max} \leq 29^{\circ}\text{C}</math> for normal occupancy zones;</li> <li><math>T(\text{sup}) \text{ max} \leq 35^{\circ}\text{C}</math> for peripheral areas.</li> </ul> <p>National standard may limit those temperatures to lower values. As "peripheral areas" are defined bands generally located along the walls of the environment facing the outside of the building, with maximum width of 1 m.</p> |                                                           |
| Hysteresis [K]               | Floor temperature limitation = enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>0,3 K</b><br>[other values in the range 0,2 K ... 3 K] |
|                              | <p>Before exiting the alarm status, the device waits until the surface temperature drops below the set threshold by an offset equal to the hysteresis value.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                           |
| Auxiliary heating            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>disabled / enabled</b>                                 |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                           |
| Communication object         | Auxiliary heating = enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | unique<br><b>separated</b>                                |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                           |
| Disabled from bus            | Auxiliary heating = enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>no / yes</b>                                           |
|                              | <p>It enables the activation and deactivation of the function through a telegram sent on the bus by a supervising device.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                           |

| Parameter name                                                                                                                                         | Conditions                                                                                                                                                                                                                                                                                                                                               | Values                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Offset from setpoint                                                                                                                                   | Auxiliary heating = enabled                                                                                                                                                                                                                                                                                                                              | <b>0,6 K</b><br>[other values in the range 0 ... 3 K]             |
| Hysteresis [K]                                                                                                                                         | Auxiliary heating = enabled                                                                                                                                                                                                                                                                                                                              | <b>0,3 K</b><br>[other values in the range 0,2 K ... 3 K]         |
| Cyclic sending interval                                                                                                                                | Auxiliary heating = enabled                                                                                                                                                                                                                                                                                                                              | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |
| Ventilation for auxiliary heating                                                                                                                      | <ul style="list-style-type: none"> <li>Command Communication Object = unique</li> <li>Heating type = floor radiant panels or ceiling radiant panels</li> </ul> OR <ul style="list-style-type: none"> <li>Command Communication Object = separated</li> <li>Heating type = radiators, electric, floor radiant panels or ceiling radiant panels</li> </ul> | <b>disabled / enabled</b>                                         |
| This option allows to match a system with high inertia as the floor radiant panels (hydronic version) with a system with low inertia as the fan-coils. |                                                                                                                                                                                                                                                                                                                                                          |                                                                   |

| Object name                            | Conditions                                                                          | Dim.   | Flags | DPT                                | Comm. Obj. No. |
|----------------------------------------|-------------------------------------------------------------------------------------|--------|-------|------------------------------------|----------------|
| Comfort setpoint (heating)             | Setpoint type = absolute or relative                                                | 2 Byte | CRWTU | [9.001] temperature (°C)           | 46             |
| Standby setpoint (heating)             | Setpoint type = absolute                                                            | 2 Byte | CRWTU | [9.001] temperature (°C)           | 48             |
| Offset standby (heating)               | Setpoint type = relative                                                            | 2 Byte | CRWTU | [9.002] temperature difference (K) | 48             |
| Economy setpoint (heating)             | Setpoint type = absolute                                                            | 2 Byte | CRWTU | [9.001] temperature (°C)           | 50             |
| Offset economy (heating)               | Setpoint type = relative                                                            | 2 Byte | CRWTU | [9.002] temperature difference (K) | 50             |
| Building protection setpoint (heating) |                                                                                     | 2 Byte | CRWTU | [9.001] temperature (°C)           | 52             |
| Heating out command                    | Command communication object = separated, Control type = 2 points hysteresis or PWM | 1 Bit  | CR-T- | [1.001] switch                     | 56             |
| Heating out command                    | Command communication object = separated, Control type = continuous                 | 1 Byte | CR-T- | [5.001] percentage (0..100%)       | 56             |

| Object name                                  | Conditions                                                                                     | Dim.   | Flags | DPT                          | Comm. Obj. No. |
|----------------------------------------------|------------------------------------------------------------------------------------------------|--------|-------|------------------------------|----------------|
| Heating and cooling out command              | Command communication<br>object = unique,<br>Tipo Control type = 2 points<br>hysteresis or PWM | 1 Bit  | CR-T- | [1.001] switch               | 56             |
| Heating and cooling out command              | Command communication<br>object = unique,<br>Control type = continuous                         | 1 Byte | CR-T- | [5.001] percentage (0..100%) | 56             |
| Auxiliary heating out command                | Command communication<br>object = separated,<br>Auxiliary heating = enabled                    | 1 Bit  | CR-T- | [1.001] switch               | 58             |
| Auxiliary heating and cooling output command | Command communication<br>object = unique,<br>Auxiliary heating = enabled                       | 1 Bit  | CR-T- | [1.001] switch               | 58             |
| Auxiliary heating disable                    | Auxiliary heating = enabled,<br>Disabled from bus = yes                                        | 1 Bit  | C-W-- | [1.003] enable               | 60             |

### Note on floor temperature limitation function

The floor heating system (warm water version) provides plastic pipes embedded in the concrete layer or placed directly under the final coating of the floor (light or "dry" system) filled by heated water. The water transfers the heat to the final coating that heats the room by radiation. The standard EN 1264 Floor heating (Part 3: Systems and components - Dimensioning) prescribes a maximum allowed temperature ( $T_{Smax}$ ) for the surface of the floor that is physiologically correct defined as:

- $T_{Smax} \leq 29^{\circ}\text{C}$  for zones of normal occupancy;
- $T_{Smax} \leq 35^{\circ}\text{C}$  for peripheral zones of the rooms.

National standards may also limit these temperatures at lower values. Peripheral zones are strips generally located along the external walls with a maximum width of 1 m.

The floor heating system (electrically powered version) involves the laying under the floor coating of an electric cable powered by the mains voltage (230 V) or low voltage (for example 12 or 45 V), possibly already prepared in the form of rolls with constant distance between sections of cable. The powered cable releases heat to the overlying coating that heats the room by radiation. The regulation is based on measurement of the temperature of the air mass, but generally requires the monitoring and limiting of the surface temperature by using a NTC-type sensor which is in contact with the floor surface.

The surface temperature limitation may be realized for several purposes:

- physiological compatibility (correct temperature at the height of the legs);
- when the system is used as auxiliary stage for heating. In this case, the heat losses to the exterior of the building are handled by the main heating stage, while the auxiliary stage only works to keep the floor temperature at a comfortable level (for example in bathrooms of residential buildings, sports centers, spas and thermal baths, etc.);
- protection against damages of the final coating due to an accidental overheating. Note that the warm water radiant panels are usually already equipped with a safety thermostat (with intervention on the hydraulic mixing group), while in the case of electrical power this device is not usable and it is common practice to realize a temperature limitation with a surface temperature sensor connected to the device.



## 7.7.3 Cooling

The **Cooling** folder includes the following parameters:

- Temperature setpoint [°C]
- Comfort temp. setpoint [°C]
- Standby temperature setpoint [°C]
- Economy temp. setpoint [°C]
- Standby temperature offset [0,1 K]
- Economy temperature offset [0,1 K]
- Building protection temp. setpoint [°C]
- Cooling type
- Control type
- Hysteresis
- Cyclic sending interval
- Min. change of value to send [%]
- PWM cycle time
- Proportional band [0,1 K]
- Integral time [min]
- Min. control value [%]
- Max. control value [%]
- Anticondensation with probe
- Active anticondensation
- Flow temperature (project)
- Anticondensation hysteresis range
- Delay for alarm signal
- Auxiliary cooling
- Disabled from bus
- Offset from setpoint
- Hysteresis
- Cyclic sending interval
- Ventilation for auxiliary cooling

### 7.7.3.1 Parameter and communication object tables

Conditions: **General** ⇒ Thermostat function = cooling or both heating and cooling.

| Parameter name              | Conditions                                                                                                       | Values                         |
|-----------------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Temperature setpoint [°C]   | Setpoint type = single                                                                                           | <b>23</b><br>[range 10 ... 50] |
| Comfort temp. setpoint [°C] | Setpoint type = absolute or relative                                                                             | <b>23</b><br>[range 10 ... 50] |
| Standby temp. setpoint [°C] | Setpoint type = absolute                                                                                         | <b>26</b><br>[range 10 ... 50] |
|                             | For a correct operation of the device the standby temperature setpoint has to be > comfort temperature setpoint. |                                |
| Economy temp. setpoint [°C] | Setpoint type = absolute                                                                                         | <b>28</b><br>[range 10 ... 50] |
|                             | For a correct operation of the device the standby temperature setpoint has to be > economy temperature setpoint. |                                |

| Parameter name                          | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Values                                                                   |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Standby temperature offset [0,1 K]      | Setpoint type = relative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>30</b><br>[range 10 ... 80]                                           |
| Economy temperature offset [0,1 K]      | Setpoint type = relative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>50</b><br>[range 10 ... 80]                                           |
|                                         | <i>For a correct operation of the device the economy temperature offset has to be &gt; standby temperature offset.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          |
| Building protection temp. setpoint [°C] |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>36</b><br>[range 30 ... 50]                                           |
| Cooling type                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>fancoils</b><br>floor radiant panels<br>ceiling radiant panels        |
|                                         | <i>If in Settings the parameter Thermostat function = both heating and cooling and Command communication object = unique, the parameter Cooling type is bound to the selection done for Heating.</i>                                                                                                                                                                                                                                                                                                                                                             |                                                                          |
| Control type                            | Settings ⇒ Command communication object = separated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>2 points hysteresis</b><br>PWM (pulse width modulation)<br>continuous |
|                                         | <i>If in Settings the parameter Thermostat function = both heating and cooling and Command communication object = unique, the parameter Control type is bound to the selection done for Heating.</i>                                                                                                                                                                                                                                                                                                                                                             |                                                                          |
| Hysteresis                              | Control type = 2 point hysteresis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>0,3 K</b><br>[other values in the range 0,2 K ... 3 K]                |
| Hysteresis position                     | Heating type = floor radiant panels,<br>ceiling radiant panels,<br>Control type = 2 point hysteresis                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>below / above</b>                                                     |
|                                         | <i>The above hysteresis is suitable in case of special applications requiring mixing group control.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                          |
| Cyclic sending interval                 | Control type = 2 point hysteresis or continuous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>no sending</b><br>[other values in the range 30 s ... 120 min]        |
| Min. change of value to send [%]        | Control type = continuous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>10</b><br>[range 0 ... 100]                                           |
| PWM cycle time                          | Control type = PWM (pulse width modulation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>15 min</b><br>[range 5 ... 240 min]                                   |
| Proportional band [0,1 K]               | Control type = continuous or PWM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>50</b><br>[range 5 ... 100]                                           |
|                                         | <p><i>The value is in tenths of Kelvin (K) degree.</i></p> <p><i>*) The field contains a preset value that depend on the selected cooling type (the value can be modified):</i></p> <ul style="list-style-type: none"> <li>• <i>fancoils: 40 (4 K)</i></li> <li>• <i>floor radiant panels: 50 (5 K)</i></li> <li>• <i>ceiling radiant panels: 50 (5 K)</i></li> </ul> <p><i>The value of the parameter Proportional band represents the max difference between the setpoint temperature and the measured temperature that causes the max control output.</i></p> |                                                                          |

| Parameter name                    | Conditions                                                                                                                                                                                                                                                                 | Values                                                                                |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Integral time [min]               | Control type = continuous or PWM                                                                                                                                                                                                                                           | <b>240</b><br>[range 0 ... 255 min]                                                   |
|                                   | <i>*) The field contains a preset value that depend on the selected cooling type (the value can be modified):</i> <ul style="list-style-type: none"> <li>• fancoils: 90 min</li> <li>• floor radiant panels: 240 min</li> <li>• ceiling radiant panels: 180 min</li> </ul> |                                                                                       |
| Min control value [%]             | Control type = continuous or PWM                                                                                                                                                                                                                                           | <b>15</b> [range 0 ... 30]                                                            |
| Max control value [%]             | Control type = continuous or PWM                                                                                                                                                                                                                                           | <b>85</b> [range 70 ... 100]                                                          |
| Anticondensation with probe       | Cooling type = floor radiant panels or ceiling radiant panels,<br>External sensors (from bus) ⇒<br>Anticondensation = enabled                                                                                                                                              | <b>disabled</b> / enabled                                                             |
| Active anticondensation           | Cooling type = floor radiant panels or ceiling radiant panels,<br>Internal sensors ⇒ Relative humidity sensor = enabled, or<br>External sensors (from bus) ⇒ Relative humidity = enabled                                                                                   | <b>disabled</b><br>enabled (project temperature)                                      |
|                                   | Cooling type = floor radiant panels or ceiling radiant panels,<br>Internal sensors ⇒ Relative humidity sensor = enabled, or<br>External sensors (from bus) ⇒ Relative humidity = enabled<br>External sensors (from bus) ⇒ Flow temperature = enabled                       | <b>disabled</b><br>enabled (comparison between flow temperature and dew-point)        |
|                                   | If flow temperature is lower than calculated dew point, the operating mode is cooling and the room thermostat is in flow request, then the thermostat will close the valve and send an alarm message over the bus.                                                         |                                                                                       |
| Flow temperature (project)        | Anticondensation active = enabled                                                                                                                                                                                                                                          | <b>19,5 °C</b><br>[other values in the range 14 °C ... 20 °C]                         |
|                                   | Only displayed if the flow temperature from external sensor (from bus) is not enabled.                                                                                                                                                                                     |                                                                                       |
| Anticondensation hysteresis range | Active anticondensation = enabled (project temperature)                                                                                                                                                                                                                    | 0,2 K / 0,3 K / 0,4 K / <b>0,5</b> / 0,6 K<br>0,8 K / 1 K / 1,5 K / 2 K / 2,5 K / 3 K |
|                                   | Before exiting the alarm condition, it is expected that the calculated dew-point temperature will drop below the delivery temperature by an offset equal to the hysteresis value.                                                                                          |                                                                                       |
| Delay for alarm signal            | Active anticondensation = enabled (project temperature)                                                                                                                                                                                                                    | <b>30 s</b><br>[other values in the range 30 s ... 120 min]                           |
| Auxiliary cooling                 |                                                                                                                                                                                                                                                                            | <b>disabled</b> / enabled                                                             |
| Disabled from bus                 | Auxiliary cooling = enabled                                                                                                                                                                                                                                                | <b>no</b> / yes                                                                       |
|                                   | This parameter enables the activation and deactivation of the function through a telegram from a bus device with supervising function.                                                                                                                                     |                                                                                       |
| Offset from setpoint              | Auxiliary cooling = enabled                                                                                                                                                                                                                                                | 0,2 K / <b>0,3 K</b> / 0,4 K / 0,5 / 0,6 K<br>0,8 K / 1 K / 1,5 K / 2 K / 2,5 K / 3 K |

| Parameter name                    | Conditions                                                    | Values                                                                                                                                                       |
|-----------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hysteresis                        | Auxiliary cooling = enabled                                   | 0,2 K / 0,3 K / 0,4 K / 0,5 / 0,6 K<br>0,8 K / <b>1 K</b> / 1,5 K / 2 K / 2,5 K / 3 K                                                                        |
| Cyclic sending interval           | Auxiliary cooling = enabled                                   | hh:mm:ss ( <b>00:00:00</b> )<br><i>00:00:00 means that the cyclic sending is not enabled.</i>                                                                |
| Ventilation for auxiliary cooling | Cooling type = floor radiant panels or ceiling radiant panels | <b>disabled</b> / enabled<br><i>This option allows to combine a high-inertial system as the floor radiant panels to a low-inertial one as the fan-coils.</i> |

| Object name                            | Conditions                                                                              | Dim.    | Flags | DPT                                | Comm. Obj. No. |
|----------------------------------------|-----------------------------------------------------------------------------------------|---------|-------|------------------------------------|----------------|
| Comfort setpoint (cooling)             | Setpoint type = absolute or relative                                                    | 2 Bytes | CRWTU | [9.001] temperature (°C)           | 47             |
| Standby setpoint (cooling)             | Setpoint type = absolute                                                                | 2 Bytes | CRWTU | [9.001] temperature (°C)           | 49             |
| Offset standby (cooling)               | Setpoint type = relative                                                                | 2 Bytes | CRWTU | [9.002] temperature difference (K) | 49             |
| Economy setpoint (cooling)             | Setpoint type = absolute                                                                | 2 Bytes | CRWTU | [9.001] temperature (°C)           | 51             |
| Offset economy (cooling)               | Setpoint type = relative                                                                | 2 Bytes | CRWTU | [9.002] temperature difference (K) | 51             |
| Building protection setpoint (cooling) |                                                                                         | 2 Bytes | CRWTU | [9.001] temperature (°C)           | 53             |
| Cooling out command                    | Command Communication<br>Object = separated<br>Control type = 2 point hysteresis or PWM | 1 Bit   | CR-T- | [1.001] switch                     | 57             |
| Cooling out command                    | Command Communication<br>Object = separated<br>Control type = continuous                | 1 Byte  | CR-T- | [5.001] percentage (0..100%)       | 57             |
| Auxiliary cooling output command       | Auxiliary cooling = enabled                                                             | 1 Bit   | CR-T- | [1.001] switch                     | 59             |
| Auxiliary cooling disable              | Auxiliary cooling = enabled,<br>Disabled from bus = yes                                 | 1 Bit   | C-W-- | [1.003] enable                     | 61             |

| Object name            | Conditions                        | Dim.  | Flags | DPT           | Comm. Obj. No. |
|------------------------|-----------------------------------|-------|-------|---------------|----------------|
| Anticondensation alarm | Active anticondensation = enabled | 1 Bit | CR-T- | [1.005] alarm | 82             |
|                        |                                   |       |       |               |                |

### About anticondensation protection function

The purpose of this function is to prevent the condensation on the thermal exchange surfaces of the installation or building when cooling is working. This function is mainly used in systems with thermal exchange consisting in surface terminals such as for the floor and ceiling cooling radiant systems. In this case the hydraulic circuits contain refrigerated water; usually the latent loads (due to the increase of air humidity in the room) are handled by air-conditioning units and the temperature and humidity conditions are far from those that could cause condensation. If this is not done in a satisfactory manner, or in case of stop of the air-conditioning units, it is necessary to provide additional safety measures to prevent or restrict the accidental formation of condensation on cold surfaces.

From a general point of view, the anticondensation protection function can be realized:

- by installing a proper room anticondensation probe; when this is active, the hydraulic circuit closes down. It is a passive protection, because the intervention takes place when condensation has already started;
- by calculating the dew-point temperature and confronting it with the conveying fluid flow temperature. If the critical condition for condensation is approaching, you can intervene by closing down the hydraulic circuit or adjusting the mixing conditions of the conveying fluid. This is an active protection because the goal is to prevent the condensation.

| Nr. | Type    | Denomination                                                                                                                                                                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1a  | Passive | Anticondensation protection by probe (via bus)                                                                                                                                   | The thermostat receives the information about condensation via bus from a different KNX device through communication object 33: Anticondensation (from bus) [DPT 1.001 switch].                                                                                                                                                                                                                                                                                                         |
| 2a  | Active  | Anticondensation protection with comparison between flow temperature (constant projected value, set as parameter on ETS and dew-point temperature (calculated by the thermostat) | Software protection that intervenes by closing down the room cooling circuit when the flow temperature defined in the hydronic project (as set in the corresponding ETS parameter) is lower than dew-point temperature calculated by the room thermostat using temperature and relative humidity values. The communication object involved is 57: Cooling out command [DPT 1.001 switch].                                                                                               |
| 2b  | Active  | Anticondensation protection with comparison between flow temperature (constant projected value, set as parameter on ETS and dew-point temperature (calculated by the thermostat) | Software protection that intervenes by closing down the room cooling circuit when the actual measured flow temperature and received via bus from a different KNX device is lower than dew-point temperature calculated by the room thermostat using temperature and relative humidity values. The communication objects involved are 27 at input: Flow temperature (from bus) [DPT 9.001 temperature °C] and 57: Cooling out command [DPT 1.001 switch].                                |
| 3   | Active  | Anticondensation protection with dew-point temperature sending over the bus and adjustment of the flow temperature                                                               | Software protection that foresees the sending on the bus of the dew-point temperature calculated by the room thermostat using temperature and relative humidity values to a KNX device capable of controlling the mixing condition of the conveying fluid for the cooling circuit. The regulation is performed by the KNX device receiving the dew-point temperature sent by the thermostat. The communication object involved is 73: Dew-point temperature [DPT 9.001 temperature °C]. |

Table 3 - Anticondensation protection modes

If an anticondensation sensor is used, it is necessary use a device provided with a potential-free signalling contact. It is possible to connect the signalling contact to an input channel of another KNX device, e.g. a pushbutton interface or a binary input (External sensors (from bus)  $\Rightarrow$  Anticondensation sensor = enabled). In this case the signal of the sensor is transmitted to the room temperature controller through the status of a communication object (case 1b described in Table 3).

If the comparison between dew-point temperature calculated by the thermostat and flow temperature of the conveying fluid is used, there are 3 options:

- if the flow temperature value is not available (case 2a of Table 3), you can insert the value used in the project (parameter Flow temperature (projected));
- if the flow temperature value is available (case 2b of Table 3), you enable the Anticondensation Active parameter for comparison;
- if an bus actuator capable of intervention on the conveying fluid's mixing is available, the thermostat sends on the bus the calculated value of the dew-point temperature; this parameter has to be enabled in the *Relative humidity control  $\Rightarrow$  Calculated psychrometric values* tab.  
The actuator compares this value with the flow temperature and, if necessary, modifies the mixing conditions in order to prevent the risk for condensation formation.

The proper anticondensation protection mode needs to be evaluated during the thermal plant design and depends on many factors such as type of building, continuity of service and desired comfort level, available KNX devices, and so on.

## 7.7.4 Main and auxiliary ventilation

The **Ventilation** folder includes the following parameters:

- Ventilation function
- Control type
- Threshold first speed [0,1 K]
- Threshold second speed [0,1 K]
- Threshold third speed [0,1 K]
- Speed control hysteresis [K]
- Speed proportional band [0,1 K]
- Min. change of value to send [%]
- Manual operation
- Coil temperature usage for fan activation (Hot start)
- Antistratification function
- Disable ventilation from bus
- Signal from bus
- Fan start delay
- Fan stop delay

The conditions for the appearance of the **Ventilation** folder are:

*Heating* ⇒ Heating type = fan-coils or Cooling type = fan-coils

or a combination of the two conditions:

*Heating* ⇒ Heating type = floor radiant panels or ceiling radiant panels and *Heating* ⇒ Ventilation for auxiliary heating = enabled

*Cooling* ⇒ Cooling type = floor radiant panels or ceiling radiant panels and *Cooling* ⇒ Ventilation for auxiliary cooling = enabled

This way two types of installations can be controlled: i) fancoil terminals or ii) radiant panels as main stage and fancoil terminals as auxiliary stage.

### 7.7.4.1 Parameter and communication object tables

| Parameter name                 | Conditions                                                                                                                                                                                                                                                               | Values                                                          |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Control type                   |                                                                                                                                                                                                                                                                          | <b>1 speed</b><br>2 speeds<br>3 speeds<br>continuous regulation |
| Threshold first speed [0,1 K]  | Control type ≥ 1 speed                                                                                                                                                                                                                                                   | <b>0</b><br>[range 0 ... 255]                                   |
|                                | The value is represented in tenths of Kelvin degrees. If the parameter Thermostat function = both heating and cooling, the threshold value is valid for both seasonal modes.                                                                                             |                                                                 |
| Threshold second speed [0,1 K] | Control type ≥ 2 speeds                                                                                                                                                                                                                                                  | <b>10</b><br>[range 0 ... 255]                                  |
|                                | The value is represented in tenths of Kelvin degrees. If the parameter Thermostat function = both heating and cooling, the threshold value is valid for both seasonal modes. For a correct operation of the ventilation, Threshold second speed > Threshold first speed. |                                                                 |

| Parameter name                        | Conditions                                                                                                                                                                                                                                                               | Values                                                                  |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Threshold third speed [0,1 K]         | Control type = 3 speeds                                                                                                                                                                                                                                                  | <b>20</b><br>[range 0 ... 255]                                          |
|                                       | The value is represented in tenths of Kelvin degrees. If the parameter Thermostat function = both heating and cooling, the threshold value is valid for both seasonal modes. For a correct operation of the ventilation, Threshold third speed > Threshold second speed. |                                                                         |
| Speed control hysteresis              | Control type = 1, 2 or 3 speeds                                                                                                                                                                                                                                          | <b>0,3 K</b><br>[other values in the range 0,2 K ... 3 K]               |
|                                       |                                                                                                                                                                                                                                                                          |                                                                         |
| Speed proportional band [0,1 K]       | Control type = continuous regulation                                                                                                                                                                                                                                     | <b>30</b><br>[range 5 ... 100]                                          |
|                                       | The value is represented in tenths of Kelvin degrees. If the parameter Thermostat function = both heating and cooling, the threshold value is valid for both seasonal modes.                                                                                             |                                                                         |
| Min. change of value to send [%]      | Control type = continuous regulation                                                                                                                                                                                                                                     | <b>10</b><br>[range 2 ... 40]                                           |
|                                       | Please refer to the Control Algorithms chapter for further information about the meaning of this parameter.                                                                                                                                                              |                                                                         |
| Manual operation                      |                                                                                                                                                                                                                                                                          | <b>not depending on the temperature</b><br>depending on the temperature |
|                                       | If the parameter = not depending on the temperature, the fan speed set by the user is not changed even when the temperature setpoint is reached; if the parameter = depending on the temperature, the fan stops when the temperature setpoint is reached.                |                                                                         |
| Hot start                             | Thermostat function = both heating and cooling,<br>External sensors (from bus) ⇒<br>coil temperature = enabled                                                                                                                                                           | <b>no / yes</b>                                                         |
|                                       | To carry out the function, a sensor for measuring the temperature of the heat exchanger of the fan coil has to be enabled. To this purpose, an external sensor (from bus) can be used.                                                                                   |                                                                         |
| Min. temp.to start ventilation [°C]   | Hot start = yes                                                                                                                                                                                                                                                          | <b>35</b><br>[range 28 ... 40]                                          |
|                                       | If enabled, the function is active only in heating mode.                                                                                                                                                                                                                 |                                                                         |
| Antistratification function           | External sensors (from bus) ⇒<br>Antistratification temperature = enabled                                                                                                                                                                                                | <b>disabled / enabled</b>                                               |
|                                       | To carry out the function, at least a sensor for measuring a second temperature value must be enabled at a different height than that of the room temperature controller. To this purpose, an external sensor (from bus) can be used.                                    |                                                                         |
| Antistratification temp. differential | Antistratification function = enabled                                                                                                                                                                                                                                    | <b>2 [K/m]</b><br>[other values in the range 0,25 ... 4,00 K/m]         |
|                                       | The DIN 1946 recommends a max temperature gradient of 2 K/m for rooms with standard height (between 2,70 and 3 m).                                                                                                                                                       |                                                                         |
| Hysteresis                            | Antistratification function = enabled                                                                                                                                                                                                                                    | <b>0,5 K</b><br>[other values in the range 0,2 ... 3 K]                 |
|                                       |                                                                                                                                                                                                                                                                          |                                                                         |
| Disable ventilation from bus          |                                                                                                                                                                                                                                                                          | <b>no / yes</b>                                                         |
|                                       |                                                                                                                                                                                                                                                                          |                                                                         |

| Parameter name          | Conditions                                                                                                                                                                                                                                       | Values                                                            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Signal from bus         | Disable ventilation from bus = yes                                                                                                                                                                                                               | <b>not inverted</b><br>inverted                                   |
| Fan start delay         |                                                                                                                                                                                                                                                  | <b>0 s</b><br>[other values in the range 10 s ... 12 min]         |
|                         | <i>This parameter is also available if the hot-start function is active (through measuring of the conveying fluid temperature at the battery for the thermal exchange). The function is active in both seasonal modes (heating and cooling).</i> |                                                                   |
| Fan stop delay          |                                                                                                                                                                                                                                                  | <b>0 s</b><br>[other values in the range 10 s ... 12 min]         |
|                         | The function allows prolonging the operation of the ventilator, dissipating in the room the residual heat or cool present in battery for the thermal exchange. The function is active in both seasonal modes (heating and cooling).              |                                                                   |
| Cyclic sending interval |                                                                                                                                                                                                                                                  | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |

| Object name                 | Conditions                           | Dim.   | Flags | DPT                              | Comm. Obj. No. |
|-----------------------------|--------------------------------------|--------|-------|----------------------------------|----------------|
| Fan continuous speed        | Control type = continuous regulation | 1 Byte | CR-T- | [5.001] percentage (0..100%)     | 62             |
| Fan speed 1                 | Control type = 1, 2 or 3 speeds      | 1 Bit  | CR-T- | [1.001] switch                   | 63             |
| Fan speed 2                 | Control type = 2 or 3 speeds         | 1 Bit  | CR-T- | [1.001] switch                   | 64             |
| Fan speed 3                 | Control type = 3 speeds              | 1 Bit  | CR-T- | [1.001] switch                   | 65             |
| Fan control disable         | Disable ventilation from bus = yes   | 1 Bit  | C-W-- | [1.002] boolean                  | 66             |
| Fan manual speed            |                                      | 1 Byte | CRW-U | [5.010] counter pulses (0...255) | 68             |
| Fan speed                   |                                      | 1 Byte | CR-T- | [5.010] counter pulses (0...255) | 67             |
| Fan manual active status    |                                      | 1 Bit  | CRWT- | [1.011] state                    | 70             |
| Fan manual speed percentage |                                      | 1 Byte | CR-T- | [5.001] percentage               | 69             |
| Fan manual speed off status |                                      | 1 Bit  | CR-T- | [1.011] state                    | 71             |

#### 7.7.4.2 Delayed fan start ("hot-start")

This function is used in case the fan forces in the room air passing through a heat exchange coil (as in the case of the terminals to the fan-coil). In the heating mode of operation, to avoid possible discomfort caused by the dispatch of cold air in the room, the room temperature controller does not start the fan until the fluid has not reached a sufficiently high temperature. This situation normally occurs at the first start or after long periods of inactivity. The function can be carried out by:

1. a temperature control (through a temperature sensor on the coil exchange battery);
2. a delayed start (function approximated);

In the first case the temperature of the heat conveying fluid is acquired at the exchange battery. The function then has an effective temperature control, but for the execution is necessary that the heat exchange coil is equipped with a sensor of minimum water temperature that acquires the temperature of the heat conveying fluid.

The effectiveness of the function depends on a field measurement of the time actually required to have sufficiently warm air from the terminal.

#### 7.7.4.3 Antistratification function

This function is used in the case of heating systems with thermal exchange of convective type for rooms with height and volume much higher than usual (atriums, fitness facility, commercial buildings, etc.). Because of the natural convection - with warm air rising to the highest altitudes of the room - the phenomenon of air stratification occurs, with energy waste and discomfort for the occupants at the same time. The function opposes to the air stratification, forcing the warm air downwards.

The antistratification function requires:

- rooms of great height;
- availability of ventilation devices able to force the air movement downwards (opposed to the natural convective movement of warm air);
- measuring of the temperature at two heights through the installation of a second temperature sensor at an adequate height in order to measure the actual air stratification (the main room temperature controller is supposed to be installed at 1.5 m).

For rooms with ordinary height (2,70 ÷ 3,00 m) the DIN 1946 standard recommends not to exceed 2 K/m in order to have an adequate comfort; this gradient may be bigger in higher rooms.

#### 7.7.4.4 2-stage configuration with fan-coils as auxiliary stage

The fan-coil units may be used both as a main stage and secondary stage. As main stage they can be combined only to radiators as auxiliary stage. If, however, the main stage is done with (floor or ceiling) radiant panels, the fan-coils can be used as auxiliary stage. In the latter case they work in automatic mode with a configurable offset with respect to the temperature setpoint for the main stage, and then carry out their compensation function while the main stage is brought in temperature with bigger inertia.

The **Ventilation** folder, that is unique, configures a main or a auxiliary stage depending on the settings choosed in the **Heating** and **Cooling** folders. Similarly, the display interface will act on manual / automatic and manual forcing of the only fan-coil.

A particular case occurs when a fan-coil unit works in a season as auxiliary stage and in the other one as main stage. It is for example the case of:

- a radiant panels system that works only for heating and has a fan-coil as auxiliary stage; the same fan-coil works as main stage for cooling;

- a radiator system that has a fan-coil as auxiliary stage for heating; the same fan coil unit functions as main stage for cooling.

In these cases with the configuration adopted, the following steps are necessary:

1. Settings  $\Rightarrow$  Thermostat function = both heating and cooling. This configuration enables both folders (heating and cooling)
2. Heating  $\Rightarrow$  Heating type = floor radiant panels or ceiling radiant panels
3. Heating  $\Rightarrow$  Command communication object = separated (if unique is chosen, the parameter Cooling  $\Rightarrow$  Cooling type does not appear)
4. Heating  $\Rightarrow$  Auxiliary heating = enabled
5. Auxiliary heating  $\Rightarrow$  Communication object = separated
6. Heating  $\Rightarrow$  Ventilation for auxiliary heating = enabled
7. Cooling  $\Rightarrow$  Cooling type = fancoils

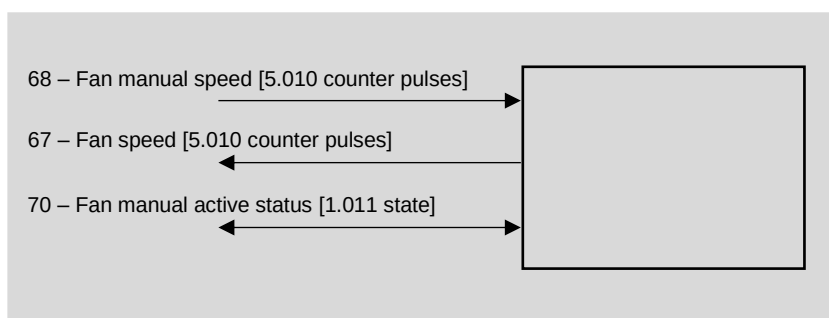
**Important!** If the fan-coil system has a 2-pipe hydraulic configuration, the objects Auxiliary heating output command (1 bit) and Cooling out command (1 bit) have to be set in logical OR in the actuator for controlling the fan-coil which in this case is unique.



An alternative solution that avoids the setting of a logic OR can be realized by configuring a main stage for heating and cooling with radiant panels through separate valves and an auxiliary stage for heating and cooling fan coil through combined valves. The offset of the auxiliary stage for cooling is set to the value 0 (zero); this corresponds to a configuration for main stage. The object Cooling out command (1 byte) is not connected so that the radiant panel system works only for heating.

#### 7.7.4.5 Remote fan speed modification

The communication objects shown in figure allow to monitor actual fan speed forced automatically (A) by the temperature controller or set locally by the user when interacting with the LCD display and the touch buttons of the room thermostat. The communication objects (from now on: C.O.) also allow to perform the same modifications remotely, for example from a supervisor software.



Picture 10

The C.O. 67 – *Fan speed* allows to evaluate the actual fan speed; the C.O. 70 – *Fan manual active status* contains the information about automatic (=0, not active) or manual (=1, active) operating mode. By modifying the C.O. 68 – *Fan manual speed*, the fan automatically switches to the setpoint speed; to return to automatic mode (A), the supervisor must exit from manual mode by modifying the C.O. 70 – *Fan manual active status* (=0, not active).

Accepted values for C.O.s 67 and 68 depend on the number of speeds set in ETS.

If *Control Type* parameter in Ventilation folder is = 1, 2 or 3 speeds, C.O.s with DPT [5.010 counter pulses] accept the following values:

- = 0: OFF
- = 1: speed 1
- = 2: speed 2 (if *Control Type* > 1 speed)
- = 3: speed 3 (if *Control Type* > 2 speed)

If *Control Type* parameter in Ventilation folder is = continuous regulation, the values of the C.O.s with DPT [5.010 counter pulses] match the following percentage of the maximum speed:

- = 0: OFF
- = 1: 20%
- = 2: 40%
- = 3: 60%
- = 4: 80%
- = 5: 100%

## 7.8 Relative humidity control

The **Relative humidity control** folder includes the following secondary folders:

- Dehumidification
- Humidification
- Calculated psychrometric values

The secondary folders **Dehumidification**, **Humidification** and **Calculated psychrometric values** appear only if a humidity sensor is enabled, either internal or external (from bus). If an external humidity sensor is enabled, the acquisition of relative humidity is made by bus from a KNX R.H. sensor.

The sensor acquires the air humidity value inside the room, which can be used for the following purposes:

- Sending over the bus (for information purpose) through DPT [9.007] percentage (%);
- Use of detected value for dew-point temperature calculations and sending on the bus through corresponding DPTs;
- Use for room ventilation through ventilation start, external intakes opening, window opening through motorized actuators. Control is performed upon thresholds;
- Use for control of thermoigrometric comfort conditions of radiant panel cooling systems equipped with integration of latent heat (starting of dedicated terminals without modification of cooling water flow temperature);
- Use for safety control in radiant panel cooling systems not equipped with integration of latent heat through calculation of critical thermoigrometric conditions (dew point) and corresponding modification of cooling water flow temperature.

### 7.8.1 Dehumidification

The secondary folder **Humidification**, when the related function is enabled, includes the following parameters:

- Operating modes where dehumidification is active
- Relative humidity setpoint for dehumidification control [%]
- Dehumidification control hysteresis [%]
- Dehumidification secondary to temperature control
- Function of integration of sensible heat
- Disable from bus

#### 7.8.1.1 Parameter and communication object tables

| Parameter name                                        | Conditions                                                                            | Values                                                            |
|-------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Dehumidification function                             | Temperature control ⇒ Settings ⇒<br>Thermostat function = both heating and<br>cooling | <b>disabled</b><br>cooling<br>heating<br>both cooling and heating |
|                                                       | Temperature control ⇒ Settings ⇒<br>Thermostat function = heating                     | <b>disabled</b> / heating only                                    |
|                                                       | Temperature control ⇒ Settings ⇒<br>Thermostat function = heating                     | <b>disabled</b> / cooling only                                    |
| Parameter that selects the dehumidification function. |                                                                                       |                                                                   |
| Humidity setpoint [%]                                 | Dehumidification function ≠ disabled                                                  | <b>55</b><br>[range 20 ... 80]                                    |

| Parameter name                            | Conditions                                                                                                                                                                                                                                                                             | Values                                                            |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Humidity hysteresis                       | Dehumidification function ≠ disabled                                                                                                                                                                                                                                                   | <b>0,8 %</b><br>[other values in the range 0,5 ... 4%]            |
| Cyclic sending interval                   | Dehumidification function ≠ disabled                                                                                                                                                                                                                                                   | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |
| Disable dehumidification control from bus | Dehumidification function ≠ disabled                                                                                                                                                                                                                                                   | <b>no / yes</b>                                                   |
| Signal from bus                           | Disable dehumidification control from bus = yes                                                                                                                                                                                                                                        | <b>not inverted</b> / inverted                                    |
| Subordinated to temperature control       | Temperature control ⇒ Settings ⇒<br>Thermostat function = cooling or both heating and cooling,<br>Temperature control ⇒ cooling ⇒<br>cooling type = floor radiant panels or ceiling radiant panels,<br>Relative humidity ⇒ dehumidification ⇒ dehumidification function = cooling only | <b>no / yes</b>                                                   |
| Dehumidification start delay              | Subordinated to temperature control = no                                                                                                                                                                                                                                               | <b>00:05:00 hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15]         |
| Integration                               | Value 00:00:00 means that the start delay is disabled.                                                                                                                                                                                                                                 |                                                                   |
| Temperature difference for integration    | Integration = yes                                                                                                                                                                                                                                                                      | <b>1,5°C</b><br>[other values in the range 0,5 °C ... 3 °C]       |
| Hysteresis for integration                | Integration = yes                                                                                                                                                                                                                                                                      | <b>0,5 K</b><br>[other values in the range 0,2 K ... 3 K]         |

| Object name                                     | Conditions                                                                                                                                                                               | Dim.   | Flags | DPT                  | Comm. Obj. No. |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------------------|----------------|
| Relative humidity setpoint for dehumidification |                                                                                                                                                                                          | 2 Byte | CRWTU | [9.007] humidity (%) | 74             |
| Dehumidification command                        |                                                                                                                                                                                          | 1 Bit  | CR-T- | [1.001] switch       | 76             |
| Dehumidification water battery command          | Temperature control ⇒ Settings ⇒<br>Thermostat function = both heating and cooling,<br>Temperature control ⇒ cooling ⇒<br>cooling type = floor radiant panels or ceiling radiant panels, | 1 Bit  | CR-T- | [1.001] switch       | 77             |

| Object name                                                                                                                                                                                                                            | Conditions                                                                                                                                                                                                                                                                                         | Dim.  | Flags | DPT             | Comm. Obj. No. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-----------------|----------------|
|                                                                                                                                                                                                                                        | Relative humidity control ⇒<br>dehumidification ⇒<br>dehumidification function = cooling only                                                                                                                                                                                                      |       |       |                 |                |
| Dehumidification integration control                                                                                                                                                                                                   | Temperature control ⇒ Settings ⇒ Thermostat function = both heating and cooling,<br>Temperature control ⇒ cooling ⇒ cooling type = floor radiant panels or ceiling radiant panels,<br>Relative humidity control ⇒ dehumidification ⇒ dehumidification function = cooling only<br>Integration = yes | 1 Bit | CR-T- | [1.001] switch  | 78             |
| <i>This object switches ON if (simultaneously) the relative humidity is greater than the relative humidity setpoint and the room temperature is greater than the setpoint of the parameter Temperature difference for integration.</i> |                                                                                                                                                                                                                                                                                                    |       |       |                 |                |
| Dehumidification control disable                                                                                                                                                                                                       | Disable dehumidification control from bus = yes                                                                                                                                                                                                                                                    | 1 Bit | C-W-- | [1.002] boolean | 79             |
|                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |       |       |                 |                |

## 7.8.2 Humidification

The secondary folder **Humidification** includes the following parameters:

- Operating modes where humidification is active
- Relative humidity setpoint for humidification control [%]
- Dehumidification control hysteresis [%]
- Cyclic sending interval
- Disable from bus

### 7.8.2.1 Parameter and communication object tables

| Parameter name                                             | Conditions                                                                          | Values                                                            |
|------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Humidification function                                    | Temperature control ⇒ Settings ⇒<br>Thermostat function = both heating and cooling  | <b>disabled</b><br>cooling<br>heating<br>both cooling and heating |
|                                                            | Temperature control ⇒ Settings ⇒<br>Thermostat function = heating                   | <b>disabled</b> / heating only                                    |
|                                                            | Temperature control ⇒ Settings ⇒<br>Thermostat function = heating                   | <b>disabled</b> / cooling only                                    |
| <i>Parameter that selects the humidification function.</i> |                                                                                     |                                                                   |
| Humidity setpoint                                          | Humidification function ≠ disabled                                                  | <b>35</b><br>[range 20 ... 80 %]                                  |
| Humidity hysteresis [%]                                    | Humidification function ≠ disabled                                                  | <b>0,8 %</b><br>[other values in the range 0,5 ... 4%]            |
| Cyclic sending interval                                    | Humidification function ≠ disabled                                                  | <b>no sending</b><br>[other values in the range 30 s ... 120 min] |
| Disable humidification control from bus                    | Humidification function ≠ disabled                                                  | <b>no</b> / yes                                                   |
| Signal from bus                                            | Humidification function ≠ disabled<br>Disable humidification control from bus = yes | <b>not inverted</b> / inverted                                    |

| Object name                                   | Conditions                                    | Dim.    | Flags | DPT                  | Comm. Obj. No. |
|-----------------------------------------------|-----------------------------------------------|---------|-------|----------------------|----------------|
| Relative humidity setpoint for humidification | Humidification function ≠ disabled            | 2 Bytes | CRWTU | [9.007] humidity (%) | 75             |
| Humidification command                        | Humidification function ≠ disabled            | 1 Bit   | CR-T- | [1.001] switch       | 80             |
| Humidification control disable                | Disable humidification control from bus = yes | 1 Bit   | C-W-- | [1.002] boolean      | 81             |

## 7.8.3 Calculated psychrometric values

The secondary folder **Calculated psychrometric values** includes the following parameters:

- Dew-point temperature
- Cyclic sending interval
- Min. change of value to send [K]
- Disable from bus

### 7.8.3.1 Parameter and communication object tables

| Parameter name                   | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                           | Values                                                               |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Dew-point temperature            |                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>disabled</b> / enabled                                            |
|                                  | <i>The dew-point temperature, if sent on the bus, allows to implement an active anticondensation protection with recalibration of the flow conditions of the conveying fluid if each mixing group has its own control device. If the thermostat is installed in an environment where no air conditioning is foreseen (e.g. toilets), it is better to exclude that environment from the control by disabling the dew-point temperature parameter.</i> |                                                                      |
| Cyclic sending interval          | Dew-point temperature = enabled                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>no sending</b><br>[other values in the range 30 s ... 120 min]    |
| Min. change of value to send [K] | Dew-point temperature = enabled                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>0,2 K</b> / no sending<br>[other values in the range 0,2 ... 3 K] |

| Object name           | Conditions                      | Dim.   | Flags | DPT                       | Comm. Obj. No. |
|-----------------------|---------------------------------|--------|-------|---------------------------|----------------|
| Dew-point temperature | Dew-point temperature = enabled | 2 Byte | CR-T- | [9.001]<br>temperature °C | 73             |

## 7.9 CO<sub>2</sub> control

The **CO<sub>2</sub> control** folder allows to configure the parameters for the air quality functions management.

It includes the following secondary folders:

- Thresholds
- Ventilation

Condition: Internal sensors  $\Rightarrow$  CO<sub>2</sub> sensor = enabled.

### 7.9.1 Thresholds

The secondary folder **Thresholds** includes the following parameters:

- Threshold 1, along with the related value [ppm] and hysteresis
- Threshold 2, along with the related value [ppm] and hysteresis
- Threshold 3, along with the related value [ppm] and hysteresis
- CO<sub>2</sub> ventilation;
- Threshold 1;
- Cyclic sending interval
- Minimum temperature [°C]
- Maximum temperature [°C]
- Minimum relative humidity [%]
- Maximum relative humidity [%]
- Maximum absolute relative humidity [g/kg x 0,1]

The following condition has to be true: External sensors (from bus)  $\Rightarrow$  Relative humidity sensor = enabled.

#### 7.9.1.1 Parameter and communication object tables

| Parameter name            | Conditions | Values                                                   |
|---------------------------|------------|----------------------------------------------------------|
| Threshold 1 – value [ppm] |            | <b>500</b><br>[range 0 ... 10000 ppm]                    |
| Threshold 1 – hysteresis  |            | <b>250</b><br>[other values in the 50 ... 500 ppm range] |
| Threshold 2 – value [ppm] |            | <b>1500</b><br>[range 0 ... 10000 ppm]                   |
| Threshold 2 – hysteresis  |            | <b>250</b><br>[other values in the 50 ... 500 ppm range] |
| Threshold 3 – value [ppm] |            | <b>5000</b><br>[range 0 ... 10000 ppm]                   |
| Threshold 3 – hysteresis  |            | <b>250</b><br>[other values in the 50 ... 500 ppm range] |

| Parameter name                               | Conditions                                                                                                       | Values                                                                 |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Threshold x - Type                           |                                                                                                                  | <b>not active</b> /<br>below only /<br>above only /<br>below and above |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – Communication object dimension | Type ≠ not active                                                                                                | <b>1 bit value</b> /<br>1 byte unsigned value /<br>1 byte percentage   |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – value (below)                  | Type = below only, below and above<br>Communication object dimension =<br>1 bit value                            | <b>Off</b> / on                                                        |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – value (above)                  | Type = above only, below and<br>above<br>Communication object dimension =<br>1 bit value                         | <b>Off</b> / on                                                        |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – value (below)                  | Type = below only, below and above<br>Communication object dimension =<br>1 byte unsigned value                  | <b>0</b><br>[range 0... 255]                                           |
|                                              |                                                                                                                  |                                                                        |
| Threshold x – value (above)                  | Type = above only, below and<br>above<br>Communication object dimension =<br>1 byte unsigned value               | <b>0</b><br>[range 0... 255]                                           |
|                                              |                                                                                                                  |                                                                        |
| Threshold x – percentage (below)             | Type = below only, below and above<br>Communication object dimension =<br>1 byte percentage                      | <b>0</b><br>[range 0... 100 %]                                         |
|                                              |                                                                                                                  |                                                                        |
| Threshold x – percentage (above)             | Type = above only, below and<br>above<br>Communication object dimension =<br>1 byte percentage                   | <b>0</b><br>[range 0... 100 %]                                         |
|                                              |                                                                                                                  |                                                                        |
| Threshold x – cyclic sending interval        | Type ≠ not active                                                                                                | <b>no sending</b><br>[other values in the 30 s ... 120 min<br>range]   |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – Lock enable                    | Type ≠ not active                                                                                                | <b>no</b> / yes                                                        |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – Behaviour at lock              | Lock enable = yes                                                                                                | <b>none</b> / send value                                               |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – Value                          | Communication object dimension =<br>1 bit value<br>Lock enable = yes<br>Behaviour at lock = send value           | <b>off</b> / on                                                        |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |
| Threshold x – Value                          | Communication object dimension =<br>1 byte unsigned value<br>Lock enable = yes<br>Behaviour at lock = send value | <b>0</b><br>[range 0... 255]                                           |
|                                              | x = 1, 2, 3                                                                                                      |                                                                        |

| Parameter name                          | Conditions                                                                                                | Values                               |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------|
| Threshold x – percentage                | Communication object dimension = 1 byte percentage<br>Lock enable = yes<br>Behaviour at lock = send value | 0<br>[range 0... 100 %]              |
|                                         | x = 1, 2, 3                                                                                               |                                      |
| Threshold x – Behaviour at bus recovery | Lock enable = yes                                                                                         | previous state /<br>unlock /<br>lock |
|                                         | x = 1, 2, 3                                                                                               |                                      |

| Object name                              | Conditions                                                                  | Dim.   | Flags | DPT                              | Comm. Obj. No. |
|------------------------------------------|-----------------------------------------------------------------------------|--------|-------|----------------------------------|----------------|
| CO <sub>2</sub> threshold x - Switch     | Type ≠ not active<br>Communication object dimension = 1 bit value           | 1 bit  | CR-T- | [1.001] switch                   | 86, 88, 90     |
|                                          | x = 1, 2, 3                                                                 |        |       |                                  |                |
| CO <sub>2</sub> threshold x - Counter    | Type ≠ not active<br>Communication object dimension = 1 byte unsigned value | 1 byte | CR-T- | [5.010] counter pulses (0...255) | 86, 88, 90     |
|                                          | x = 1, 2, 3                                                                 |        |       |                                  |                |
| CO <sub>2</sub> threshold x - Percentage | Type ≠ not active<br>Communication object dimension = 1 byte percentage     | 1 byte | CR-T- | [5.001] percentage               | 86, 88, 90     |
|                                          | x = 1, 2, 3                                                                 |        |       |                                  |                |
| CO <sub>2</sub> threshold x - Lock       | Type ≠ not active<br>Lock enable = yes                                      | 1 bit  | C-W-- | [1.003] enable                   | 87, 89, 91     |
|                                          | x = 1, 2, 3                                                                 |        |       |                                  |                |

## 7.9.2 Ventilation

The secondary folder **Ventilation** includes the following parameters:

- Communication object dimension;
- Min. change of value to send [%];
- Cyclic sending interval;
- CO<sub>2</sub> value < threshold 1;
- Threshold 1 < CO<sub>2</sub> value < threshold 2;
- Threshold 2 < CO<sub>2</sub> value < threshold 3;
- Threshold 3 < CO<sub>2</sub> value;
- Hysteresis (for continuous speed);
- Min. CO<sub>2</sub> [ppm] (for continuous speed);
- Max. CO<sub>2</sub> [ppm] (for continuous speed);
- Min. ventilation speed [%] (for continuous speed);
- Max. ventilation speed [%] (for continuous speed);
- CO<sub>2</sub> ventilation lock;
- Disable ventilation from bus.

The following condition has to be true:

- Internal sensors ⇒ CO<sub>2</sub> sensor = enabled;
- CO<sub>2</sub> control ⇒ Thresholds ⇒ CO<sub>2</sub> ventilation = enabled.

## 7.9.2.1 Parameter and communication object tables

| Parameter name                                            | Conditions                                                                                         | Values                                                                                                                 |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| CO <sub>2</sub> ventilation                               |                                                                                                    | <b>disabled</b> / enabled                                                                                              |
| Ventilation – Communication object dimension              | CO <sub>2</sub> ventilation = enabled                                                              | 4 single bit values /<br>1 byte unsigned value /<br><b>1 byte percentage</b> /<br>1 byte percentage (continuous speed) |
| Cyclic sending interval                                   | CO <sub>2</sub> ventilation = enabled                                                              | <b>no sending</b><br>[other values in the 30 s ... 120 min range]                                                      |
| CO <sub>2</sub> value < threshold 1 – Bit x               | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>4 single bit values   | <b>off</b> / on                                                                                                        |
|                                                           | x = 1, 2, 3, 4                                                                                     |                                                                                                                        |
| Threshold 1 < CO <sub>2</sub> value < threshold 2 – Bit x | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>4 single bit values   | <b>off</b> / on                                                                                                        |
|                                                           | x = 1, 2, 3, 4                                                                                     |                                                                                                                        |
| Threshold 2 < CO <sub>2</sub> value < threshold 3 – Bit x | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>4 single bit values   | <b>off</b> / on                                                                                                        |
|                                                           | x = 1, 2, 3, 4                                                                                     |                                                                                                                        |
| Threshold 3 < CO <sub>2</sub> value – Bit x               | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>4 single bit values   | <b>off</b> / on                                                                                                        |
|                                                           | x = 1, 2, 3, 4                                                                                     |                                                                                                                        |
| CO <sub>2</sub> value < threshold 1                       | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte unsigned value | <b>0</b><br>[range 0... 255]                                                                                           |
| Threshold 1 < CO <sub>2</sub> value < threshold 2         | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte unsigned value | <b>0</b><br>[range 0... 255]                                                                                           |
| Threshold 2 < CO <sub>2</sub> value < threshold 3         | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte unsigned value | <b>0</b><br>[range 0... 255]                                                                                           |
| CO <sub>2</sub> value > threshold 3                       | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte unsigned value | <b>0</b><br>[range 0... 255]                                                                                           |
| CO <sub>2</sub> value < threshold 1                       | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte percentage     | <b>0 %</b><br>[range 0... 100 %]                                                                                       |
| Threshold 1 < CO <sub>2</sub> value < threshold 2         | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension =<br>1 byte percentage     | <b>0 %</b><br>[range 0... 100 %]                                                                                       |

| Parameter name                                    | Conditions                                                                                                                                                                    | Values                                                         |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Threshold 2 < CO <sub>2</sub> value < threshold 3 | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage                                                                                   | <b>0 %</b><br>[range 0... 100 %]                               |
| CO <sub>2</sub> value > threshold 3               | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage                                                                                   | <b>0 %</b><br>[range 0... 100 %]                               |
| Min. change of value to send [%]                  | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>10 %</b><br>[range 2... 40 %]                               |
| Hysteresis                                        | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>250 ppm</b><br>(other values in the 50 ... 500 ppm range)   |
| Min. CO <sub>2</sub> [ppm]                        | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>400 ppm</b><br>(other values in the 0 ... 10000 ppm range)  |
| Max. CO <sub>2</sub> [ppm]                        | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>5000 ppm</b><br>(other values in the 0 ... 10000 ppm range) |
| Min. ventilation speed [%]                        | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>0 %</b><br>[range 0... 100 %]                               |
| Max. ventilation speed [%]                        | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage (continuous speed)                                                                | <b>100 %</b><br>[range 0... 100 %]                             |
| CO <sub>2</sub> ventilation lock                  | CO <sub>2</sub> ventilation = enabled                                                                                                                                         | <b>disabled / enabled</b>                                      |
| Behaviour at lock                                 | CO <sub>2</sub> ventilation = enabled<br>CO <sub>2</sub> ventilation lock = enabled                                                                                           | <b>none / send value</b>                                       |
| Behaviour after bus on                            | CO <sub>2</sub> ventilation = enabled<br>CO <sub>2</sub> ventilation lock = enabled                                                                                           | <b>previous state /</b><br>lock /<br>unlock                    |
| Lock value – Bit x                                | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 4 single bit values<br>CO <sub>2</sub> ventilation lock = enabled<br>Behaviour at lock = send value | <b>off / on</b>                                                |
|                                                   | x = 1, 2, 3, 4                                                                                                                                                                |                                                                |

| Parameter name               | Conditions                                                                                                                                                                                                          | Values                           |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Lock value                   | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte unsigned value<br>CO <sub>2</sub> ventilation lock = enabled<br>Behaviour at lock = send value                                     | <b>0</b><br>[range 0... 255]     |
| Lock value                   | CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage or 1 byte percentage (continuous speed)<br>CO <sub>2</sub> ventilation lock = enabled<br>Behaviour at lock = send value | <b>0 %</b><br>[range 0... 100 %] |
| Disable ventilation from bus | CO <sub>2</sub> ventilation = enabled                                                                                                                                                                               | <b>no</b> / yes                  |
| Signal from bus              | CO <sub>2</sub> ventilation = enabled<br>Disable ventilation from bus = yes                                                                                                                                         | <b>not inverted</b> / inverted   |

| Object name                                | Conditions                                                                                                                                       | Dim.   | Flags | DPT                              | Comm. Obj. No. |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------------------------------|----------------|
| CO <sub>2</sub> ventilation bit x - Switch | Thresholds ⇒ CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 bit value                                               | 1 bit  | CR-T- | [1.001] switch                   | 92, 93, 94, 95 |
|                                            | x = 1, 2, 3, 4                                                                                                                                   |        |       |                                  |                |
| CO <sub>2</sub> ventilation - Counter      | Thresholds ⇒ CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte unsigned value                                     | 1 Byte | CR-T- | [5.010] counter pulses (0...255) | 92             |
| CO <sub>2</sub> ventilation - Percentage   | Thresholds ⇒ CO <sub>2</sub> ventilation = enabled<br>Communication object dimension = 1 byte percentage or 1 byte percentage (continuous speed) | 1 Byte | CR-T- | [5.001] percentage               | 92             |
| CO <sub>2</sub> ventilation - Lock         | Thresholds ⇒ CO <sub>2</sub> ventilation = enabled<br>CO <sub>2</sub> ventilation – Lock = enabled                                               | 1 bit  | C-W-- | [1.003] enable                   | 96             |
| CO <sub>2</sub> ventilation - Disable      | Thresholds ⇒ CO <sub>2</sub> ventilation = enabled<br>Disable ventilation from bus = yes                                                         | 1 bit  | C-W-- | [1.003] enable                   | 97             |

## 7.10 Energy saving

In order to realize energy-saving functions, window contacts (to detect the opening of windows or doors), presence and movement sensors and card holders can be used.

The **Energy saving** folder includes the following secondary folders:

- Window contacts
- Presence sensors
- Card holder

The folder is available if the following conditions are satisfied:

- *Internal sensors*  $\Rightarrow$  *Temperature sensor = enabled, or*
- *External sensors (from bus)*  $\Rightarrow$  *Room Temperature sensor = enabled.*

### 7.10.1 Window contacts

The **Window contacts** secondary folder appears if at least one sensor dedicated to this function is enabled i.e. if the following condition is verified:

- *External sensors (from bus)*  $\Rightarrow$  *Windows contact sensor 1 or 2 = enabled.*

The **Window contacts** folder includes the following parameters:

- Window contacts function
- Wait time to building protection mode

#### 7.10.1.1 Parameter and communication object tables

| Parameter name                        | Conditions                                                                                           | Values                                             |
|---------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Window contacts function              |                                                                                                      | disabled / enabled                                 |
|                                       | <i>This parameter enables the window contact function.</i>                                           |                                                    |
| Wait time to building protection mode | Window contacts function = enabled                                                                   | 00:01:00 hh:mm:ss<br>[range 00:00:00 ... 18:12:15] |
|                                       | Time interval before the automatic switching of the device to the Building protection operating mode |                                                    |

| Nome oggetto                           | Conditions                         | Dim.  | Flags | DPT                    | Comm. Obj. No. |
|----------------------------------------|------------------------------------|-------|-------|------------------------|----------------|
| Windows contact sensor 1<br>(from bus) | Window contacts function = enabled | 1 Bit | C-WTU | [1.019]<br>window/door | 28             |
| Windows contact sensor 2<br>(from bus) | Window contacts function = enabled | 1 Bit | C-WTU | [1.019]<br>window/door | 29             |

## 7.10.2 Presence sensors

The **Presence sensors** folder includes the following parameters:

- Presence sensors function
- Presence sensors use
- Thermostat modes
- Absence time to switch HVAC mode

For this function external sensors (from bus) can be used, such as the ekinex EK-SM2-TP movement sensor or the ekinex EK-DX2-TP (X = B, C, D, E) presence sensor. The following condition has to be true:

- *External sensors (from bus) ⇒ Presence sensor 1 and/or Presence sensor 2 = enabled*

### 7.10.2.1 Parameter and communication object tables

| Parameter name                   | Conditions                                                                                                                    | Values                                                                                     |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Presence sensors function        |                                                                                                                               | <b>disabled / enabled</b>                                                                  |
|                                  | Parameter that enables the presence sensor function.                                                                          |                                                                                            |
| Presence sensors use             | Presence sensor function = enabled                                                                                            | <b>comfort extension</b><br>comfort limitation<br>comfort extension and comfort limitation |
|                                  |                                                                                                                               |                                                                                            |
| Thermostat modes                 | Presence sensor function = enabled,<br>Presence sensors use = comfort extension and comfort limitation, or comfort limitation | <b>comfort-standby</b><br>comfort-economy                                                  |
|                                  |                                                                                                                               |                                                                                            |
| Absence time to switch HVAC mode | Presence sensor function = enabled                                                                                            | <b>00:01:00 hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15]                                  |
|                                  | Time interval before the automatic switching of the operating mode set in the Thermostat modes parameter.                     |                                                                                            |

| Object name                  | Conditions                         | Dim.  | Flags | DPT               | Comm. Obj. No. |
|------------------------------|------------------------------------|-------|-------|-------------------|----------------|
| Presence sensor 1 (from bus) | Presence sensor function= enabled  | 1 Bit | C-WTU | [1.018] occupancy | 30             |
|                              |                                    |       |       |                   |                |
| Presence sensor 2 (from bus) | Presence sensor function = enabled | 1 Bit | C-WTU | [1.018] occupancy | 31             |
|                              |                                    |       |       |                   |                |

## 7.10.3 Card holder

The **Card holder** secondary folder appears only if the corresponding sensor is enabled, i.e. if the following condition is true:

- *External sensors (from bus) ⇒ Card holder contact = enabled*

The **Card holder** folder includes the following parameters:

- Card holder function
- On card insertion switch HVAC mode to
- Activation delay on card insertion
- On card removal switch HVAC mode to
- Activation delay on card removal

### 7.10.3.1 Parameter and communication object tables

| Parameter name                        | Conditions                                                                                                                       | Values                                                    |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Card holder function                  |                                                                                                                                  | <b>disabled / enabled</b>                                 |
|                                       | Parameter that enables the card holder function.                                                                                 |                                                           |
| On card insertion switch HVAC mode to | Card holder function = enabled                                                                                                   | none<br><b>comfort</b><br>standby<br>economy              |
|                                       | This parameter defines to which operating mode the device should automatically switch, after inserting the card into the holder. |                                                           |
| Activation delay on card insertion    | Card holder function = enabled                                                                                                   | <b>00:00:00 hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15] |
|                                       | Time interval before the automatic switching to the new operating mode, after inserting the card into the holder.                |                                                           |
| On card removal switch HVAC mode to   | Card holder function = enabled                                                                                                   | none<br><b>standby</b><br>economy<br>building protection  |
|                                       | This parameter defines to which operating mode the device should automatically switch, after removing the card from the holder.  |                                                           |
| Activation delay on card removal      | Card holder function = enabled                                                                                                   | <b>00:00:00 hh:mm:ss</b><br>[range 00:00:00 ... 18:12:15] |
|                                       | Time interval before the automatic switching to the new operating mode, after removing the card from the holder.                 |                                                           |

| Object name                       | Conditions                     | Dim.  | Flags | DPT                  | Comm. Obj. No. |
|-----------------------------------|--------------------------------|-------|-------|----------------------|----------------|
| Contact of card holder (from bus) | Card holder function = enabled | 1 Bit | C-WTU | [1.018]<br>occupancy | 17             |

### Note on card holder function

The information of card insertion/removal in/from a card holder allows you to directly control the temperature by means of the room thermostat, while sending the object value on the bus allows you to control other room functions with KNX (lighting, electrical loads, feedback status for the hotel reception, etc.) depending on the configuration done with ETS. The value of the setpoint temperature and the switching have to be defined with

the hotel responsible in accordance with the target of energy saving and level of service to be offered to the guests.

#### Conventional (not KNX) card holder

With a conventional card holder the status (card present or absent) of a signal contact is detected through an input of the device configured as *[DI] card holder contact sensor*. This way you can detect only the insertion and extraction of the card, but it cannot be detected e.g. the access of users with different profiles (guests, service staff, maintenance workforce).

#### KNX card holder

With a KNX card holder you can differentiate the switching to be carried out; this is not resolved by the parameters of the room temperature controller, but through the definition of scenes that are received by the device. Depending on the available device, advanced functions are possible (e.g. different user profiles).

## 7.11 Logic functions

The EK-ET3-TP KNX Multisensor controller allows to use some useful logic functions (AND, OR, NOT and exclusive OR) in order to implement complex functions in the building automation system.

You can configure:

- 8 channels of logical functions
- 4 inputs for each channel

Each object value, if desired, can be individually inverted by inserting a NOT logic operator.

For each channel, a parameter *Delay after bus voltage recovery* is available: this parameter represents the time interval between the bus voltage recovery and the first reading of the input communication objects for evaluating the logic functions.



In case of uncorrect connection of the input communication object or electrical trouble on bus resulting in a failed input reading request, the logic output of the corresponding channel can be calculated by setting default input values.

The communication object that represents the logic function output is sent on the bus on event basis, i.e. when the status changes; alternatively, a cyclic sending can be set.

### 7.11.1 Parameter and communication object tables

The following condition has to be true: *General*  $\Rightarrow$  *Logic functions* = *enabled*.

| Parameter name                   | Conditions                                                                                                                                                                            | Values                                                                    |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Logic function                   |                                                                                                                                                                                       | <b>disabled</b> / <b>enabled</b>                                          |
| Logic operation                  | Logic function = enabled                                                                                                                                                              | <b>OR</b> / <b>AND</b> / <b>XOR</b>                                       |
|                                  | <i>XOR (eXclusive OR)</i>                                                                                                                                                             |                                                                           |
| Delay after bus voltage recovery | Logic function = enabled                                                                                                                                                              | <b>00:00:04.000 hh:mm:ss.fff</b><br>[range 00:00:00.000 ... 00:10:55.350] |
|                                  | <i>Time interval between the bus voltage recovery and the first reading of the input communication objects, for evaluating the logic functions</i>                                    |                                                                           |
| Output cyclic sending interval   | Logic function = enabled                                                                                                                                                              | <b>no sending</b><br>[other value in range 30 s ... 120 min]              |
|                                  | <i>No sending means that the output state of the logic function is updated on the bus only on change event. Different values imply cyclic sending on the bus of the output state.</i> |                                                                           |
| Output sending                   | Logic function = enabled                                                                                                                                                              | <b>both values</b> /<br>only value 0 /<br>only value 1                    |
|                                  | <i>It allows to decide the trigger for sending the result of the operation to output.</i>                                                                                             |                                                                           |
| Output update                    | Logic function = enabled                                                                                                                                                              | <b>at value change</b> /<br>at value or input change                      |
|                                  | <i>It identifies the event for the output update.</i>                                                                                                                                 |                                                                           |
| Logic object x                   | Logic function = enabled                                                                                                                                                              | <b>disabled</b> / <b>enabled</b>                                          |
|                                  | <i>x = 1, 2, 3, 4</i>                                                                                                                                                                 |                                                                           |
| Logic object x negated           | Logic function = enabled<br>Logic object x = enabled                                                                                                                                  | <b>no</b> / <b>yes</b>                                                    |

| Parameter name                 | Conditions                                                                                                                                                                                                   | Values          |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                                | <i>x = 1, 2, 3, 4</i><br><i>By denying the logical state of the corresponding input, it is possible to implement complex combinatorial logics. Example: Output=(NOT(Logic object 1) OR Logic object 2)).</i> |                 |
| Logic object x read at startup | Logic function = enabled<br>Logic object x = enabled                                                                                                                                                         | no / yes        |
|                                | <i>x = 1, 2, 3, 4</i>                                                                                                                                                                                        |                 |
| Logic object x default value   | Logic function = enabled<br>Logic object x = enabled                                                                                                                                                         | none / off / on |
|                                | <i>x = 1, 2, 3, 4</i>                                                                                                                                                                                        |                 |

| Object name                | Conditions                                                      | Dim.  | Flags | DPT            | Comm. Obj. No.                         |
|----------------------------|-----------------------------------------------------------------|-------|-------|----------------|----------------------------------------|
| Logic function X – Input 1 | Logic function X = enabled<br>Logic object 1 = enabled          | 1 Bit | C-WTU | [1.001] switch | 98, 103, 108, 113, 118, 123, 128, 133  |
|                            | <i>X = 1, ..., 8</i>                                            |       |       |                |                                        |
| Logic function X – Input 2 | Logic function X = enabled<br>Logic object 2 = enabled          | 1 Bit | C-WTU | [1.001] switch | 99, 104, 109, 114, 119, 124, 129, 134  |
|                            | <i>X = 1, ..., 8</i>                                            |       |       |                |                                        |
| Logic function X – Input 3 | Logic function X = enabled<br>Logic object 3 = enabled          | 1 Bit | C-WTU | [1.001] switch | 100, 105, 110, 115, 120, 125, 130, 135 |
|                            | <i>X = 1, ..., 8</i>                                            |       |       |                |                                        |
| Logic function X – Input 4 | Logic function X = enabled<br>Logic object 4 = enabled          | 1 Bit | C-WTU | [1.001] switch | 101, 106, 111, 116, 121, 126, 131, 136 |
|                            | <i>X = 1, ..., 8</i>                                            |       |       |                |                                        |
| Logic function X – Output  | Logic function X = enabled<br>At least one logic object enabled | 1 Bit | CR-T- | [1.001] switch | 102, 107, 112, 117, 122, 127, 132, 137 |
|                            | <i>X = 1, ..., 8</i>                                            |       |       |                |                                        |

## 8 List of communication objects

| Nr. | Communication object name                              | Size   | Flags | Datapoint type               |
|-----|--------------------------------------------------------|--------|-------|------------------------------|
| 0   | Technical alarm                                        | 1 Bit  | C-W-- | [1.005] DPT_Alarm            |
| 1   | Leds intensity percentage                              | 1 Byte | C-W-- | [5.001] DPT_Percentage       |
| 2   | Temperature value                                      | 2 Byte | CR-T- | [9.001] DPT_Value_Temp       |
| 3   | Temperature threshold 1 - Switch                       | 1 Bit  | CR-T- | [1.001] DPT_Switch           |
| 4   | Temperature threshold 1 - Lock                         | 2 Byte | C-W-- | [1.001] DPT_Switch           |
| 5   | Temperature threshold 1 - Value (from bus)             | 2 Byte | C-W-- | [9.001] DPT_Value_Temp       |
| 6   | Temperature threshold 2 - Switch                       | 1 Bit  | CR-T- | [1.001] DPT_Switch           |
| 7   | Temperature threshold 2 - Lock                         | 2 Byte | C-W-- | [1.001] DPT_Switch           |
| 8   | Temperature threshold 2 - Value (from bus)             | 2 Byte | C-W-- | [9.001] DPT_Value_Temp       |
| 9   | CO2 - Value                                            | 2 Byte | CR-T- | [9.008] DPT_Value_AirQuality |
| 10  | Humidity value (2 bytes)                               | 2 Byte | CR-T- | [9.007] DPT_Value_Humidity   |
| 11  | Humidity value (1 byte)                                | 2 Byte | CR-T- | [5.001] DPT_Scaling          |
| 12  | Humidity threshold 1 - Switch                          | 1 Bit  | CR-T- | [1.001] DPT_Switch           |
| 13  | Humidity threshold 1 - Lock                            | 1 Bit  | C-W-- | [1.003] DPT_Enable           |
| 14  | Humidity threshold 1 - Value (2 bytes, from bus)       | 2 Byte | C-W-- | [9.007] DPT_Value_Humidity   |
| 15  | Humidity threshold 1 - Value (1 byte, from bus)        | 1 Byte | C-W-- | [5.001] DPT_Scaling          |
| 16  | Humidity threshold 2 - Switch                          | 1 Bit  | CR-T- | [1.001] DPT_Switch           |
| 17  | Humidity threshold 2 - Lock                            | 1 Bit  | C-W-- | [1.003] DPT_Enable           |
| 18  | Humidity threshold 2 - Value (2 bytes, from bus)       | 2 Byte | C-W-- | [9.007] DPT_Value_Humidity   |
| 19  | Humidity threshold 2 - Value (1 bytes, from bus)       | 1 Byte | C-W-- | [5.001] DPT_Scaling          |
| 20  | Thermostat - Room temperature (from bus)               | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 21  | Thermostat - Humidity (2 bytes, from bus)              | 2 Byte | C-WTU | [9.007] DPT_Value_Humidity   |
| 22  | Thermostat - Humidity (1 byte, from bus)               | 2 Byte | C-WTU | [5.001] DPT_Scaling          |
| 23  | Thermostat - Antistratification temperature (from bus) | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 24  | Thermostat - Outdoor temperature (from bus)            | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 25  | Thermostat - Coil temperature (from bus)               | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 26  | Thermostat - Floor temperature (from bus)              | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 27  | Thermostat - Flow temperature (from bus)               | 2 Byte | C-WTU | [9.001] DPT_Value_Temp       |
| 28  | Thermostat - Windows contact sensor 1 (from bus)       | 2 Byte | C-WTU | [1.019] DPT_Window_Door      |
| 29  | Thermostat - Windows contact sensor 2 (from bus)       | 2 Byte | C-WTU | [1.019] DPT_Window_Door      |
| 30  | Thermostat - Presence sensor 1 (from bus)              | 1 Bit  | C-WTU | [1.018] DPT_Occupancy        |
| 31  | Thermostat - Presence sensor 2 (from bus)              | 1 Bit  | C-WTU | [1.018] DPT_Occupancy        |
| 32  | Thermostat - Contact of card holder (from bus)         | 1 Bit  | C-WTU | [1.018] DPT_Occupancy        |
| 33  | Thermostat - Anticondensation (from bus)               | 1 Bit  | C-WTU | [1.001] DPT_Switch           |
| 34  | Thermostat - Weighted temperature                      | 2 Byte | CR-T- | [9.001] DPT_Value_Temp       |
| 35  | Thermostat - Heating/cooling status out                | 1 Bit  | CR-T- | [1.100] DPT_Heat_Cool        |
| 36  | Thermostat - Heating/cooling status in                 | 1 Bit  | C-W-- | [1.100] DPT_Heat_Cool        |
| 37  | Thermostat - HVAC mode in                              | 1 Byte | C-W-- | [20.102] DPT_HVACMode        |
| 38  | Thermostat - HVAC forced mode in                       | 1 Byte | C-W-- | [20.102] DPT_HVACMode        |
| 39  | Thermostat - HVAC mode out                             | 1 Byte | CR-T- | [20.102] DPT_HVACMode        |
| 40  | Thermostat - HVAC manual mode                          | 1 Byte | CRWTU | [20.102] DPT_HVACMode        |

| Nr. | Communication object name                                 | Size    | Flags | Datapoint type             |
|-----|-----------------------------------------------------------|---------|-------|----------------------------|
| 41  | Thermostat - Building protection HVAC mode active         | 1 Bit   | CR-T- | [1.011] DPT_State          |
| 42  | Thermostat - Chrono active status                         | 1 Bit   | CR-T- | [1.011] DPT_State          |
| 43  | Thermostat - Actual setpoint                              | 2 Bytes | CR-T- | [9.001] DPT_Value_Temp     |
| 44  | Thermostat - Manual setpoint                              | 2 Bytes | C-W-- | [9.001] DPT_Value_Temp     |
| 45  | Thermostat - Manual setpoint status                       | 1 Bit   | CRWTU | [1.011] DPT_State          |
| 46  | Thermostat – Setpoint in                                  | 2 Bytes | CRWTU | [9.001] temperature (°C)   |
| 46  | Thermostat - Setpoint in                                  | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 47  | Thermostat - Comfort setpoint (cooling)                   | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 48  | Thermostat - Standby setpoint (heating)                   | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 48  | Thermostat - Offset standby (heating)                     | 2 Bytes | CRWTU | [9.002] DPT_Value_Tempd    |
| 49  | Thermostat - Standby setpoint (cooling)                   | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 49  | Thermostat - Offset standby (cooling)                     | 2 Bytes | CRWTU | [9.002] DPT_Value_Tempd    |
| 50  | Thermostat - Economy setpoint (heating)                   | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 50  | Thermostat - Offset economy (heating)                     | 2 Bytes | CRWTU | [9.002] DPT_Value_Tempd    |
| 51  | Thermostat - Economy setpoint (cooling)                   | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 51  | Thermostat - Offset economy (cooling)                     | 2 Bytes | CRWTU | [9.002] DPT_Value_Tempd    |
| 52  | Thermostat - Building protection setpoint (heating)       | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 53  | Thermostat - Building protection setpoint (cooling)       | 2 Bytes | CRWTU | [9.001] DPT_Value_Temp     |
| 54  | Thermostat - Disable room temperature controller          | 1 Bit   | C-W-- | [1.001] DPT_Switch         |
| 55  | Thermostat - Room temperature controller status           | 1 Bit   | CR-T- | [1.003] DPT_Enable         |
| 56  | Thermostat - Heating and cooling out command              | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 56  | Thermostat - Heating and cooling out command              | 1 Byte  | CR-T- | [5.001] DPT_Scaling        |
| 56  | Thermostat - Heating out command                          | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 56  | Thermostat - Heating out command                          | 1 Byte  | CR-T- | [5.001] DPT_Scaling        |
| 57  | Thermostat - Cooling out command                          | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 57  | Thermostat - Cooling out command                          | 1 Byte  | CR-T- | [5.001] DPT_Scaling        |
| 58  | Thermostat - Auxiliary heating output command             | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 58  | Thermostat - Auxiliary heating and cooling output command | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 59  | Thermostat - Auxiliary cooling output command             | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 60  | Thermostat - Auxiliary heating disable                    | 1 Bit   | C-W-- | [1.003] DPT_Enable         |
| 61  | Thermostat - Auxiliary cooling disable                    | 1 Bit   | C-W-- | [1.003] DPT_Enable         |
| 62  | Thermostat - Fan continuous speed                         | 1 Bit   | CR-T- | [5.001] DPT_Scaling        |
| 63  | Thermostat - Fan speed 1                                  | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 64  | Thermostat - Fan speed 2                                  | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 65  | Thermostat - Fan speed 3                                  | 1 Bit   | CR-T- | [1.001] DPT_Switch         |
| 66  | Thermostat - Fan control disable                          | 1 Bit   | C-W-- | [1.002] DPT_Bool           |
| 67  | Thermostat - Fan speed                                    | 1 Byte  | CR-T- | [5.010] DPT_Value_1_Ucount |
| 68  | Thermostat - Fan manual speed                             | 1 Byte  | CRW-U | [5.010] DPT_Value_1_Ucount |
| 69  | Thermostat - Fan manual speed percentage                  | 1 Byte  | CR-T- | [5.001] DPT_Scaling        |
| 70  | Thermostat - Fan manual active status                     | 1 Bit   | CRWT- | [1.011] DPT_State          |
| 71  | Thermostat - Fan manual speed off status                  | 1 Bit   | CR-T- | [1.011] DPT_State          |
| 72  | Thermostat - Room temperature controller alarm            | 1 Bit   | CR-T- | [1.005] DPT_Alarm          |

| Nr.                                             | Communication object name                                    | Size     | Flags | Datapoint type                                         |
|-------------------------------------------------|--------------------------------------------------------------|----------|-------|--------------------------------------------------------|
| 73                                              | Thermostat - Dew-point temperature                           | 2 Bytes  | CR-T- | [9.001] DPT_Value_Temp                                 |
| 74                                              | Thermostat - Relative humidity setpoint for dehumidification | 2 Bytes  | CRWTU | [9.007] DPT_Value_Humidity                             |
| 75                                              | Thermostat - Relative humidity setpoint for humidification   | 2 Bytes  | CRWTU | [9.007] DPT_Value_Humidity                             |
| 76                                              | Thermostat - Dehumidification command                        | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 77                                              | Thermostat - Dehumidification water battery command          | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 78                                              | Thermostat - Dehumidification integration control            | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 79                                              | Thermostat - Dehumidification control disable                | 1 Bit    | C-W-- | [1.002] DPT_Bool                                       |
| 80                                              | Thermostat - Humidification command                          | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 81                                              | Thermostat - Humidification control disable                  | 1 Bit    | C-W-- | [1.002] DPT_Bool                                       |
| 82                                              | Thermostat - Anticondensation alarm                          | 1 Bit    | CR-T- | [1.005] DPT_Alarm                                      |
| 83                                              | Thermostat - Thermal generator lock                          | 1 Bit    | C-W-- | [1.005] DPT_Alarm                                      |
| 84                                              | Thermostat - HVAC scene number <b>(not implemented)</b>      | 1 Byte   | C-W-- | [17.001] DPT_SceneNumber,<br>[18.001] DPT_SceneControl |
| 85                                              | Thermostat - Alarm text                                      | 14 Bytes | CR-T- | [16.000] DPT_String_ASCII                              |
| 86                                              | CO <sub>2</sub> threshold 1 - Percentage                     | 1 Byte   | CR-T- | [5.001] DPT_Scaling                                    |
| 86                                              | CO <sub>2</sub> threshold 1 - Counter                        | 1 Byte   | CR-T- | [5.010] DPT_Value_1_Ucount                             |
| 86                                              | CO <sub>2</sub> threshold 1 - Switch                         | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 87                                              | CO <sub>2</sub> threshold 1 - Lock                           | 1 Bit    | C-W-- | [1.003] DPT_Enable                                     |
| 88                                              | CO <sub>2</sub> threshold 2 - Percentage                     | 1 Byte   | CR-T- | [5.001] DPT_Scaling                                    |
| 88                                              | CO <sub>2</sub> threshold 2 - Counter                        | 1 Byte   | CR-T- | [5.010] DPT_Value_1_Ucount                             |
| 88                                              | CO <sub>2</sub> threshold 2 - Switch                         | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 89                                              | CO <sub>2</sub> threshold 2 - Lock                           | 1 Bit    | C-W-- | [1.003] DPT_Enable                                     |
| 90                                              | CO <sub>2</sub> threshold 3 - Percentage                     | 1 Byte   | CR-T- | [5.001] DPT_Scaling                                    |
| 90                                              | CO <sub>2</sub> threshold 3 - Counter                        | 1 Byte   | CR-T- | [5.010] DPT_Value_1_Ucount                             |
| 90                                              | CO <sub>2</sub> threshold 3 - Switch                         | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 91                                              | CO <sub>2</sub> threshold 3 - Lock                           | 1 Bit    | C-W-- | [1.003] DPT_Enable                                     |
| 92                                              | CO <sub>2</sub> ventilation bit 1 - switch                   | 1 Byte   | CR-T- | [5.010] DPT_Value_1_Ucount                             |
| 92                                              | CO <sub>2</sub> ventilation - Counter                        | 1 Byte   | CR-T- | [5.001] DPT_Scaling                                    |
| 92                                              | CO <sub>2</sub> ventilation - Percentage                     | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 93                                              | CO <sub>2</sub> ventilation bit 2 - switch                   | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 94                                              | CO <sub>2</sub> ventilation bit 3 - switch                   | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 95                                              | CO <sub>2</sub> ventilation bit 4 - switch                   | 1 Bit    | CR-T- | [1.001] DPT_Switch                                     |
| 96                                              | CO <sub>2</sub> ventilation - Lock                           | 1 Bit    | C-W-- | [1.003] DPT_Enable                                     |
| 97                                              | CO <sub>2</sub> ventilation - Disable                        | 1 Bit    | C-W-- | [1.003] DPT_Enable                                     |
| 98, 103,<br>108, 113,<br>118, 123,<br>128, 133  | Logic function x <sup>1</sup> – Input 1                      | 1 Bit    | C-WTU | [1.001] DPT_Switch                                     |
| 99, 104,<br>109, 114,<br>119, 124,<br>129, 134  | Logic function x <sup>1</sup> – Input 1                      | 1 Bit    | C-WTU | [1.001] DPT_Switch                                     |
| 100, 105,<br>110, 115,<br>120, 125,<br>130, 135 | Logic function x <sup>1</sup> – Input 1                      | 1 Bit    | C-WTU | [1.001] DPT_Switch                                     |

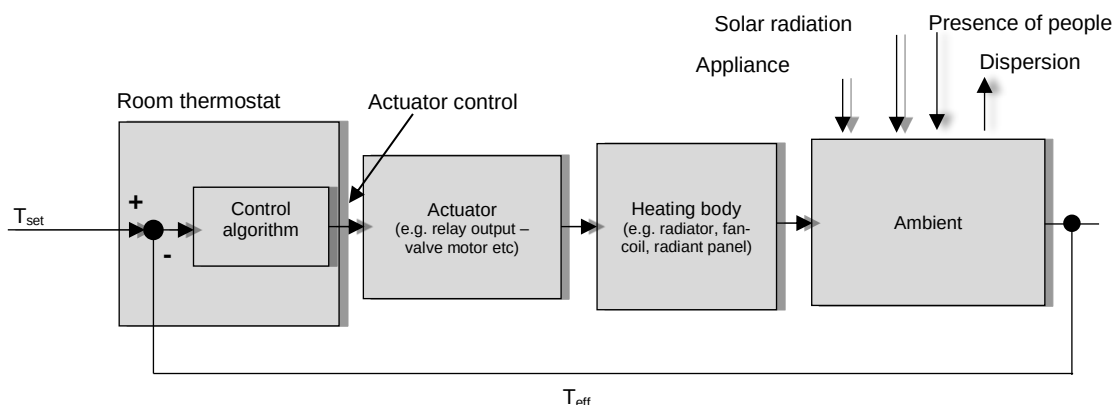
<sup>1</sup> "x" can span from 1 to 8.

| Nr.                                             | Communication object name      | Size  | Flags | Datapoint type     |
|-------------------------------------------------|--------------------------------|-------|-------|--------------------|
| 101, 106,<br>111, 116,<br>121, 126,<br>131, 136 | Logic function $x^1$ – Input 1 | 1 Bit | C-WTU | [1.001] DPT_Switch |
| 102, 107,<br>112, 117,<br>122, 127,<br>132, 137 | Logic function $x^1$ – Output  | 1 Bit | CR-T- | [1.001] DPT_Switch |

## 9 Control algorithms

In figura sono rappresentati i componenti di un generico sistema di controllo per la temperatura ambiente. Il termostato rileva il valore attuale di temperatura della massa d'aria ambiente ( $T_{eff}$ ) e la confronta con il valore di temperatura desiderato o setpoint ( $T_{set}$ ).

The components of a common generic control system for ambient temperature are represented in Picture 11. The room thermostat measures the actual temperature of the air mass ( $T_{eff}$ ) and constantly compares it to the setpoint value ( $T_{set}$ ).



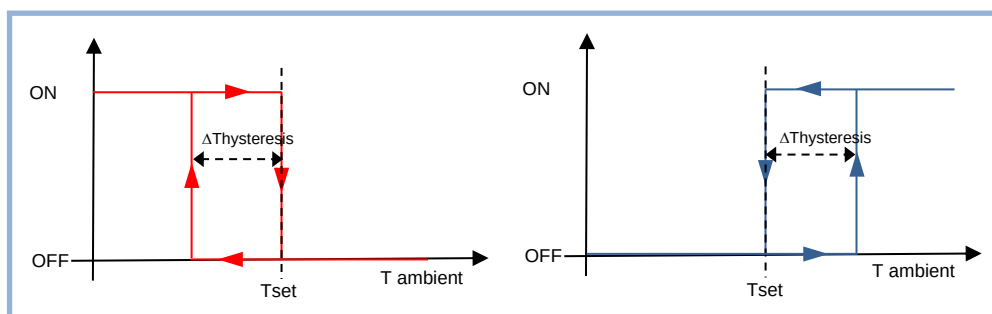
Picture 11 - Generic control system for ambient temperature

The control algorithm, basing on the difference between  $T_{set}$  and  $T_{eff}$ , processes a command value which can be of analog or On / Off type; the command is represented by a CO that is transmitted via bus, either periodically or event based, to a KNX actuator device.

The output of the actuator device is the driving variable of the control system, which can be e.g. a flow rate of water or air. The control system realized by the room thermostat is of feedback type, namely the algorithm takes into account the effects on the system in order to change the control action on the same entity.

### 9.1 Two-point control with hysteresis

This control algorithm, which is also known as On / Off, is the most classic and popular. The control provides for the on / off switching of the system following a hysteresis loop, i.e. two threshold levels are considered for the switching instead of a single one (see Picture 12).

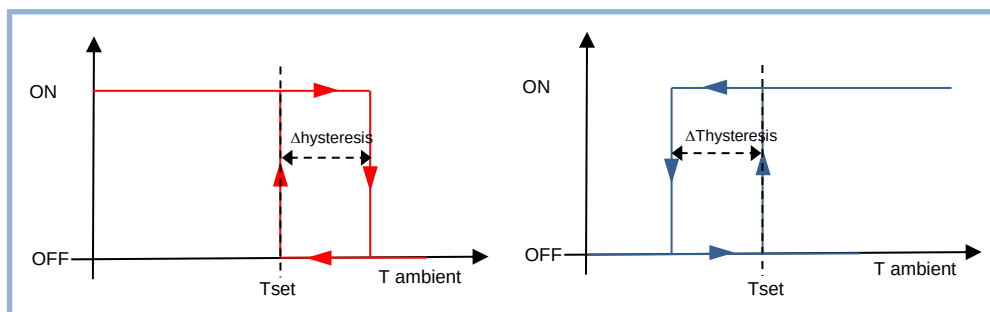


Picture 12 - Two-points control with hysteresis

**Heating mode:** when the measured temperature is lower than the value of the difference ( $T_{set} - \Delta T_{hysteresis}$ ), whereby  $\Delta T_{hysteresis}$  identifies the differential adjustment of the boilers, the device activates the heating system by sending a message or KNX telegram to the actuator that handles the heating system; when the measured temperature reaches the desired temperature (Setpoint), the device disables the heating system by sending another message. In this way, there are two decision thresholds for activation and deactivation of the heating, the first being the level ( $T_{set} - \Delta T_{hysteresis}$ ) below which the device activates the system, whereas the second is the desired temperature above which the heating system is deactivated.

**Cooling mode:** When the measured temperature is higher than the value of the difference ( $T_{set} + \Delta T_{hysteresis}$ ), whereby  $\Delta T_{hysteresis}$  identifies the differential adjustment of the cooler, the device activates the air conditioning system by sending a message or KNX telegram to the actuator that handles it; when the measured temperature falls below the desired temperature  $T_{set}$  the device turns off the air conditioning system by sending another message. In this way, there are two decision thresholds for activation and deactivation of the cooling: the first being the level ( $T_{set} + \Delta T_{hysteresis}$ ) above which the device activates the system, whereas the second is the desired temperature below which the air conditioning system is deactivated. In the ETS application program, two different parameters are available for the hysteresis value for heating and cooling: the values usually differ depending on the system type and its inertia.

In those applications where floor or ceiling radiant panels are present, it is possible to realize a different 2-point room temperature control. This type of control must be paired either to a proper regulation system for flow temperature that takes into account all internal conditions or an optimizer that exploits the thermal capacity of the building to adjust the energy contributions (Picture 13). In this type of control the hysteresis ( $\Delta T_{hysteresis}$ ) or the room temperature high limit ( $T_{set} + \Delta T_{hysteresis}$ ) represent the maximum level of deviation that the user is willing to accept during plant conduction.



Picture 13 - Two-points control with hysteresis and flow temperature

**Heating mode** – When the measured temperature is lower than the desired temperature  $T_{set}$ , the device activates the heating system by sending a message or KNX telegram to the actuator that handles it; when the measured temperature reaches the value ( $T_{set} + \Delta T_{hysteresis}$ ), whereby  $\Delta T_{hysteresis}$  identifies the differential adjustment of the boilers the device disables the heating system by sending another message. In this way, there are two decision thresholds for activation and deactivation of the heating, the first being the desired temperature  $T_{set}$  below which the device activates the system, whereas the second is the value ( $T_{set} + \Delta T_{hysteresis}$ ), above which the heating system is deactivated.

**Cooling mode** – When the measured temperature is higher than the desired temperature  $T_{set}$ , the device activates the air conditioning system by sending a message or KNX telegram to the actuator that handles it; when the measured temperature reaches the value ( $T_{set} - \Delta T_{hysteresis}$ ), whereby  $\Delta T_{hysteresis}$  identifies the

differential adjustment of the air conditioning system, the device disables the air conditioning system by sending another message. In this way, there are two decision thresholds for activation and deactivation of the air conditioning system: the first being the desired temperature  $T_{set}$  above which the device activates the system, whereas the second is the value  $(T_{set} - \Delta T_{hysteresis})$  below which the air conditioning system is deactivated.

In the ETS application program, two different parameters are available for the hysteresis value for heating and cooling: the values usually differ depending on the system type and its inertia.

In the ETS application program, the default 2-point hysteresis control algorithm foresees inferior hysteresis for heating and superior for cooling. If Heating and/or cooling type = floor radiant panels or ceiling radiant panels, it is possible to select the hysteresis position according to the described second mode, i.e. with superior hysteresis for heating and inferior for cooling.

The desired temperature ( $T_{set}$ ) is generally different for each one of the 4 operating modes and for heating/cooling modes. The different values are defined for the first time during ETS configuration and can be modified later on. In order to optimize energy saving (for each extra degree of room temperature, outbound dispersions and energy consumption go up 6%), it is possible to take advantage of the multifunctionality of the domotic system, for example with:

- Hour programming with automatic commutation of the operating mode by means of KNX supervisor;
- Automatic commutation of the operating mode according to presence of people in the room;
- Automatic commutation of the operating mode according to window opening for air refreshment;
- Circuit deactivation when desired temperature is reached;
- Flow temperature reduction in case of partial load.

## 9.2 Continuous Proportional-Integral control

The continuous proportional-integral (PI) controller is described by the following equation:

$$\text{control variable}(t) = Kp \times \text{error}(t) + Ki \times \int_0^t \text{error}(\tau) d\tau$$

whereby:

$\text{error}(t) = (\text{Setpoint} - \text{Measured temperature})$  in heating

$\text{error}(t) = (\text{Measured temperature} - \text{Setpoint})$  in cooling

$Kp$  = proportional constant

$Ki$  = integral constant

The control variable is composed by 2 numbers, one depending proportionally from the error and one depending from the integral of the error itself.

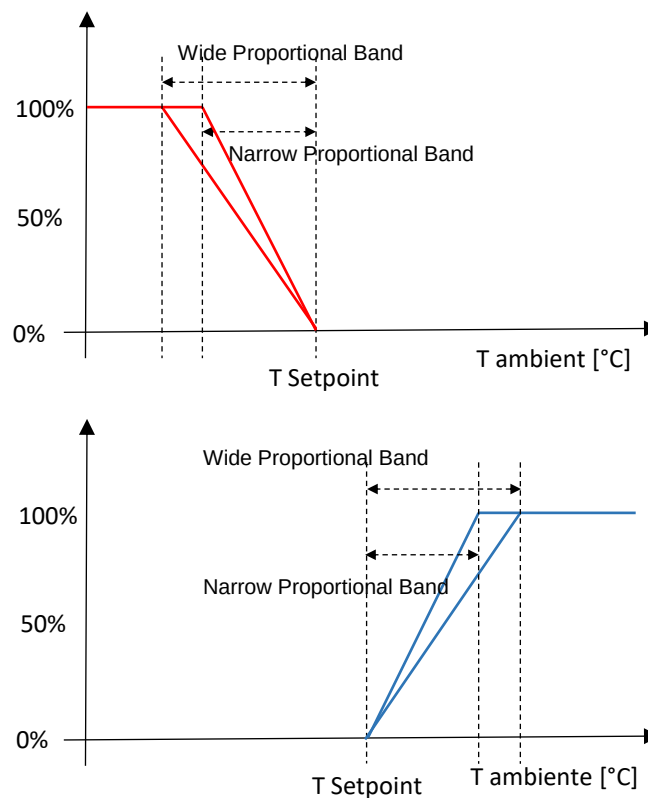
Practically, some more intuitive values are used:

$$\text{Proportional Band BP [K]} = \frac{100}{Kp}$$

$$\text{Integral Time Ti [min]} = \frac{Kp}{Ki}$$

**The Proportional Band is the error value that determines the maximum span of the control variable at 100%.**

For example, a controller with Proportional Band = 5 K regulates at 100% when Setpoint = 20°C and Measured Temperature is ≤ 15 °C in heating mode; in cooling mode, it regulates at 100% when Setpoint = 24°C and Measured Temperature is ≥ 29°C. As shown in Picture 14, a controller with a narrow Proportional Band provides higher control variable values for smaller errors compared to a controller with a wider Proportional Band.



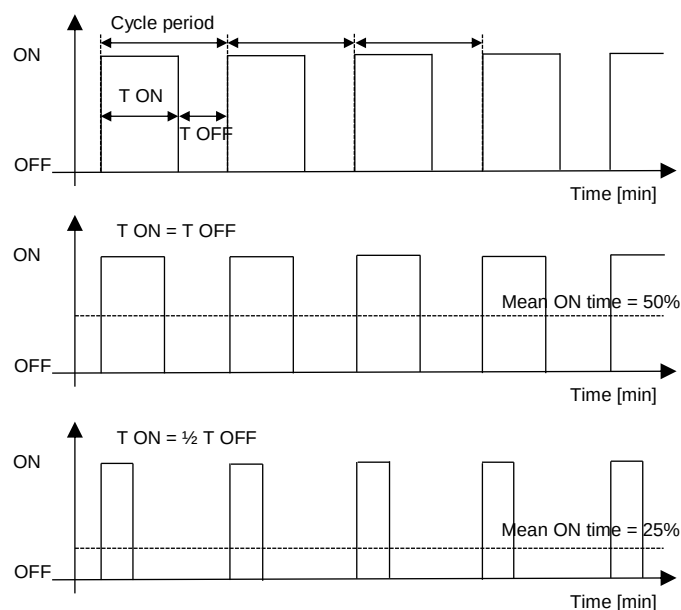
Picture 14 - Continuous Proportional-Integral control

**Integral Time is the amount of time necessary to repeat the value of the control variable of a purely proportional controller, when error is constant.** For example, with a purely proportional controller with Proportional Band = 4 K, if Setpoint = 20°C and Measured Temperature = 18°C, the control variable will be 50%. If Integral Time = 60 minutes, if error remains constant, the control variable will be 100% after 1 hour, i.e. the controller will add to the control variable a contribution equal to the value due to its proportional part.

In heating and air conditioning systems, a purely proportional controller cannot guarantee reaching the Setpoint. An integral action is mandatory in order to reach the Setpoint: for this reason the integral action is also called automatic reset.

### 9.3 PWM Proportional-Integral control

The proportional-integral PWM (Pulse Width Modulator) controller uses an analog control variable to modulate the duration of the time intervals in which a binary output is in the On or Off state. The controller operates in a periodic manner over a cycle, and in each period it maintains the output to the On value for a time proportional to the value of the control variable. As shown in Picture 15, by varying the ratio between the ON time and the OFF time, the average time of activation of the output varies, and consequently the average intake of heating or cooling power supplied to the environment.



Picture 15 - PWM Proportional-Integral control

This type of controller is well suited for use with On / Off type actuators, such as relays and actuators for zone valves, which are less expensive (both for electrical and mechanical components) than proportional actuators. A distinctive advantage of this type of controller, compared with the raw On / Off controller already described, is that it eliminates the inertia characteristics of the system: it allows significant energy savings, because you avoid unnecessary interventions on the system introduced by the 2-point control with hysteresis and it only provides the power required to compensate for losses in the building.

Every time the user or the supervisor changes the desired temperature setpoint, the cycle time is interrupted, the control output is reprocessed and the PWM restarts with a new cycle: this allows the system to reach its steady state more quickly.

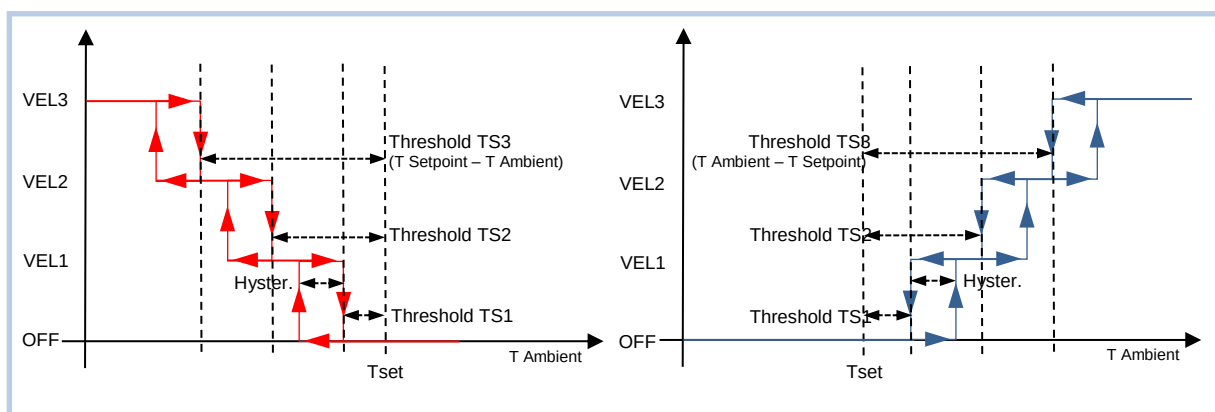
| Terminal type        | Proportional Band [K] | Integral Time [min] | Cycle Period [min] |
|----------------------|-----------------------|---------------------|--------------------|
| Radiators            | 5                     | 150                 | 15-20              |
| Electrical heaters   | 4                     | 100                 | 15-20              |
| Fan-coil             | 4                     | 90                  | 15-20              |
| Floor radiant panels | 5                     | 240                 | 15-20              |

Guidelines for choosing the proper parameters of a PMW Proportional-Integral controller:

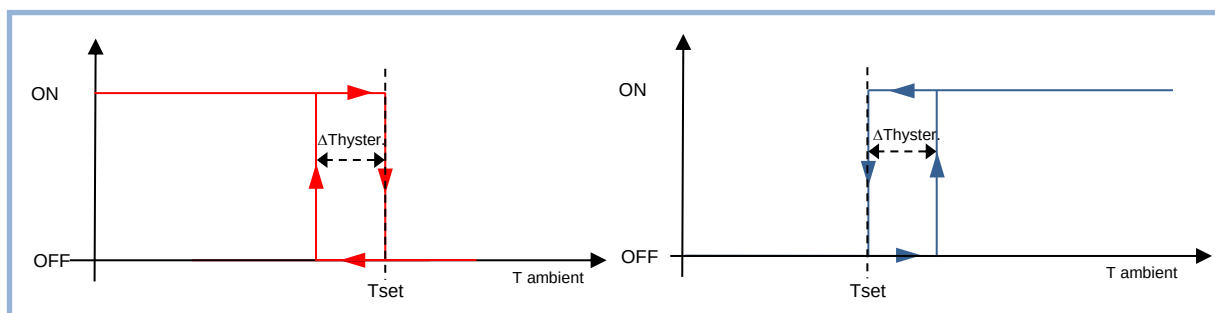
- Cycle time: for low-inertial systems such as heating and air conditioning systems, short cycle times must be chosen (10-15 minutes) to avoid oscillations of the room temperature.
- Narrow proportional band: wide and continuous oscillations of the room temperature, short setpoint settling time.
- Wide proportional band: small or no oscillations of the room temperature, long setpoint settling time.
- Short integral time: short setpoint settling time, continuous oscillations of the room temperature.
- Long integral time: long setpoint settling time, no oscillations of the room temperature.

## 9.4 Fancoils with On / Off fan speed control

The multi-stage fan control is similar to the 2-point control with hysteresis described in the previous section. The speed of the fan is chosen basing on the difference between the set point ( $T_{set}$ ) and the actual measured temperature ( $T_{eff}$ ). The substantial difference from the described 2-points algorithm is that, in this case, there can be up to three stages (depending the number of available fan speeds); a different hysteresis threshold exists for each stage transition. At a given stage, i.e. speed setting, a threshold causes the switching to a higher speed (or none, for the highest stage) while the other causes the switching to a lower speed (or off, for the lowest stage). Usually, but not inherently, a same threshold value will be used for both transitions that lead to each speed from the adjacent ones.



Picture 16



Picture 17

The diagram on the left in Picture 16 refers to the speed control of the fan-coil (with 3-stage operation) in heating mode. Please note that for each speed, two thresholds values are assigned, one for activation and one for deactivation. The thresholds values are specified in the ETS application program, and their effect can be summarized as follows:

- Speed 1 (1st stage) – The speed is activated when the room temperature value is lower than the value ( $T_{set} - \text{Threshold TS1} - \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{set} - \text{Threshold TS1}$ ); the first speed is also deactivated when a higher speed needs to be activated. The default value for Threshold TS1 parameter is 0 K.

- Speed 2 (2nd stage) – The speed is activated when the room temperature value is lower than the value ( $T_{Set} - \text{Threshold TS2} - \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{Set} - \text{Threshold TS2}$ ); the second speed is also deactivated when speed V3 needs to be activated.
- Speed 3 (3rd stage) – The speed is activated when the room temperature value is lower than the value ( $T_{Set} - \text{Threshold TS3} - \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{Set} - \text{Threshold TS3}$ ).

The parameter *Speed control hysteresis* in ETS application program represents the hysteresis value which is common to all speed stages and unified for heating and cooling.

As for the intercept valve of the water exchange coil (2-pipe system) or the intercept valve of the water heating coil (4-pipe system), a 2-point hysteresis algorithm can be used in the application program, operating on the same Setpoints. When the room the temperature is lower than the value ( $T_{Set} - \Delta T_{\text{hysteresis}}$ ) the device sends the valve activation command; the intercept valve is deactivated when the room temperature reaches the  $T_{Set}$  value and simultaneously the fan speed 1 deactivates. In this way, you can avoid the formation of the black “blows” on the wall which are caused by the circulation of water inside the coil without heat exchange.

The diagram on the right in Picture 16 refers to the speed control of the fan-coil (with 3-stage operation) in air conditioning mode. Please note that for each speed, two thresholds values are assigned, one for activation and one for deactivation. The thresholds values are specified in the ETS application program, and their effect can be summarized as follows:

- Speed 1 (1st stage) – The speed is activated when the room temperature value is lower than the value ( $T_{Set} + \text{Threshold TS1} + \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{Set} + \text{Threshold TS1}$ ); the first speed is also deactivated when a higher speed needs to be activated. The default value for Threshold TS1 parameter is 0 K.
- Speed 2 (2nd stage) – The speed is activated when the room temperature value is lower than the value ( $T_{Set} + \text{Threshold TS2} + \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{Set} + \text{Threshold TS2}$ ); the second speed is also deactivated when speed V3 needs to be activated.
- Speed 3 (3rd stage) – The speed is activated when the room temperature value is lower than the value ( $T_{Set} + \text{Threshold TS3} + \text{Hysteresis}$ ) and deactivated when the room temperature value reaches the value ( $T_{Set} + \text{Threshold TS3}$ ).

As for the intercept valve of the water exchange coil (2-pipe system) or the intercept valve of the water heating coil (4-pipe system), a 2-point hysteresis algorithm can be used in the application program, operating on the same Setpoints. When the room the temperature is lower than the value ( $T_{Set} + \Delta T_{\text{hysteresis}}$ ) the device sends the valve activation command; the intercept valve is deactivated when the room temperature reaches the  $T_{Set}$  value and simultaneously the fan speed 1 deactivates.

Both figures refer to a 3-speed fan coil control. For 2-speed and 1-speed case all information in this paragraph apply, with the onyl difference that not all speeds will be controlled.

In fancoils applications, where both heating and cooling modes are active, the activations thresholds are the same on the 2 operating modes.

In order to coordinate the fan action with the intercept valve of the exchange coil, you need to properly choose the right hysteresis values: for instance, by selecting the parameters *Threshold first speed* = 0 K and *Speed control hysteresis* = 0,3 K in *Ventilation* folder, the parameter *Hysteresis* in the *Heating and/or cooling* folder must be 0,3 K in order to guarantee that the valve on the exchange coil will be open when speed 1 is activated.

Another element of flexibility is the possibility to subordinate the fan manual operation to the desired temperature  $T_{Set}$ . By selecting in ETS the parameter *Manual operation = not depending on the temperature* in *Ventilation* folder, the ventilation will continue to work at the user defined speed even when the desired temperature is reached. Viceversa, by selecting in ETS the parameter *Manual operation = depending on the temperature*, the manual ventilation will be cut off when the desired temperature is reached.

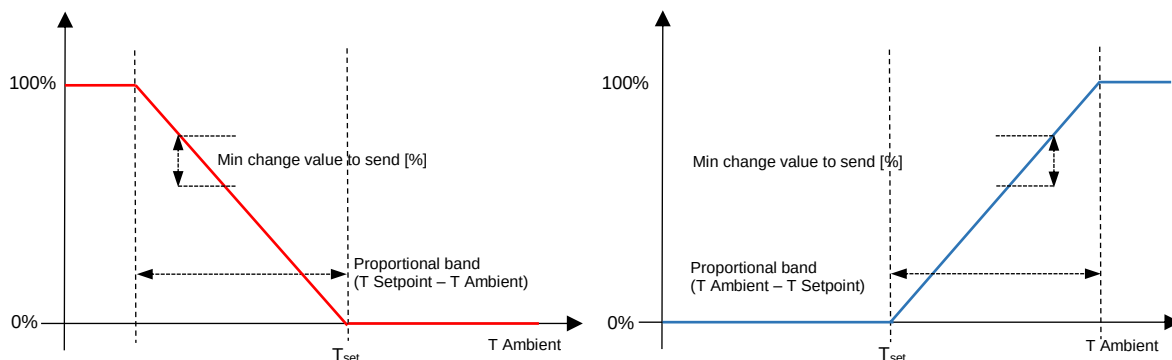
The communication between the controller and the actuator can be realized both with communication objects [1.001] DPT\_Switch (63-64-65, Fan speed 1-2-3) or with a single object [5.001] DPT\_Scaling (62, Fan continuous speed). The object (62, Fan continuous speed), with ON/OFF fan coil speed control, does not change continuously but gets discrete values according to the hysteresis of the ON/OFF windows, as shown in the following table.

| Automatic fan speed   | Fan speed communication objects, type<br>[1.001] DPT_Switch |    |    | Continuous fan speed communication<br>object, [5.001] DPT_Scaling |
|-----------------------|-------------------------------------------------------------|----|----|-------------------------------------------------------------------|
|                       | V1                                                          | V2 | V3 |                                                                   |
| Control type: 3-speed |                                                             |    |    |                                                                   |
| OFF                   | 0                                                           | 0  | 0  | 0 %                                                               |
| 1                     | 1                                                           | 0  | 0  | 33,3 %                                                            |
| 2                     | 0                                                           | 1  | 0  | 66,7 %                                                            |
| 3                     | 0                                                           | 0  | 1  | 100 %                                                             |
| Control type: 2-speed |                                                             |    |    |                                                                   |
| OFF                   | 0                                                           | 0  | -  | 0 %                                                               |
| 1                     | 1                                                           | 0  | -  | 50 %                                                              |
| 2                     | 0                                                           | 1  | -  | 100 %                                                             |
| Control type: 1-speed |                                                             |    |    |                                                                   |
| OFF                   | 0                                                           | -  | -  | 0 %                                                               |
| 1                     | 1                                                           | -  | -  | 100 %                                                             |

During switching, before activating the new speed, the others must be deactivated in order not to damage the fan motor: both binary and continuous communication objects are therefore updated to OFF value (0%) before being updated by the internal controller to the next speed.

## 9.5 Fancoils with fan speed continuous control

This kind of control does not involve independent 1-bit communication objects but only a single 1-byte communication object (DPT 5.001 percentage): this means that it is no longer necessary to deactivate previous speeds before activating the next.



Picture 18 - Fancoils with fan speed continuous control

The definition of hysteresis levels must be directly performed on the fan coil actuator. The application program offers the parameter *Proportional band*, which has the same value for both heating and cooling; this parameter determines the fan intervention gradient. The parameter *Min. change of value to send [%]* is defined in order to limit the frame exchange on the bus.

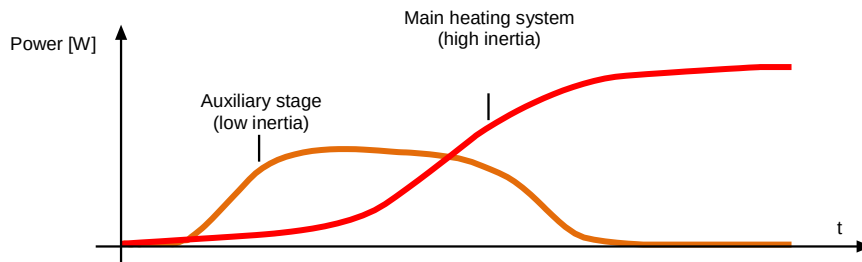


The 1-byte communication object *Fan continuous speed* (62) changes continuously according to the curve shown in Picture 18. Please refer to the previous paragraph to evaluate differences with the 1-2-3-speed control, where the same communication object has discrete values.

## 9.6 2-points control with hysteresis for auxiliary heating / cooling system

Some heating / cooling systems show a very large response inertia; this is mostly due to the fact that a relevant part of building mass is involved in the thermal exchange.

In order to improve response time for start-up or ambient temperature transients, auxiliary systems with substantially lower inertia are used in support of the main system whenever the difference between setpoint ( $T_{set}$ ) and measured temperatures ( $T_{eff}$ ) becomes significant.



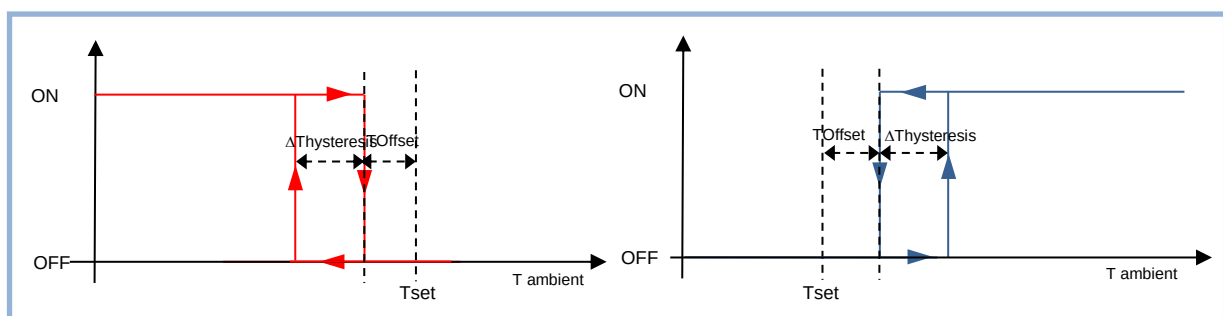
Picture 19 - 2-points control with hysteresis for auxiliary system

The auxiliary – also called “second-tier” – system, in the initial stage, contributes to heat / cool the environment and then stops its action when the difference between  $T_{set}$  and  $T_{eff}$  is lower and can be addressed by the system with higher inertia.

The control algorithm used for the second-tier system is the 2-points On/Off control with hysteresis.

### Heating mode

When the measured temperature ( $T_{eff}$ ) is lower than the value of the lower threshold ( $T_{set} - \Delta T_{Offset} - \Delta T_{hysteresis}$ ), the device activates the auxiliary heating by sending the relative frame to the proper actuator; when the measured temperature reaches the value ( $T_{set} - \Delta T_{Offset}$ ), the auxiliary heating system is turned off by sending the relative frame to the proper actuator.



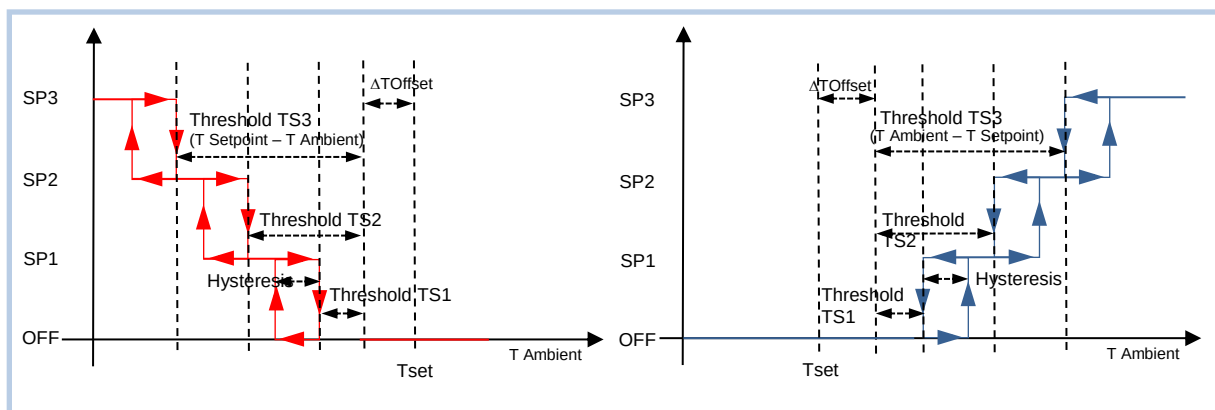
Picture 20

### Cooling mode

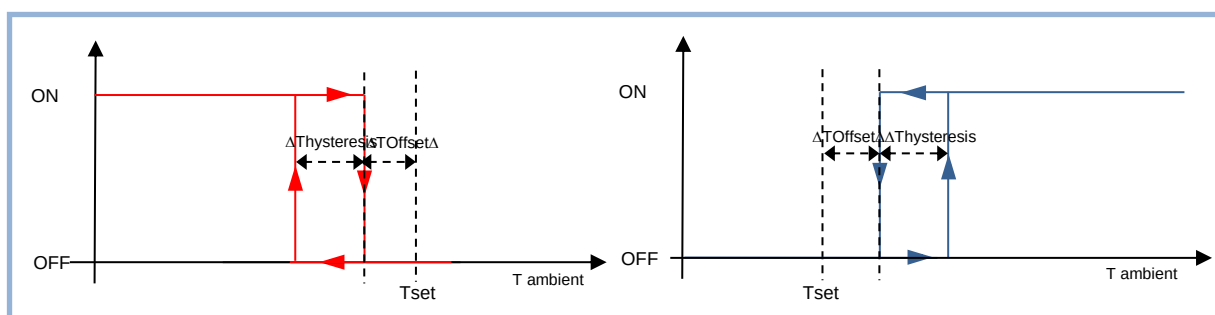
When the measured temperature ( $T_{eff}$ ) is higher than the value of the lower threshold ( $T_{set} + \Delta T_{Offset} + \Delta T_{hysteresis}$ ), the device activates the auxiliary cooling by sending the relative frame to the proper actuator; when the measured temperature reaches the value ( $T_{set} + \Delta T_{Offset}$ ), the auxiliary cooling system is turned off by sending the relative frame to the proper actuator.

## 9.7 Auxiliary stage with fan coil

In some heating / cooling system, an auxiliary fan coil system which operates on air volumes is paired with an high inertial system (such as floor radiant panels): EK-ET3-TP Multisensor controller can be easily configured for this kind of application.



Picture 21



Picture 22

As for the configuration of the auxiliary stage, you can apply the same rules already expressed in the ON/OFF and continuous fan coil control paragraph. Particularly relevant here is the auxiliary stage intervention offset,  $\Delta T_{\text{Offset}}$ , which matches the parameter *Setpoint difference* in *Heating and/or cooling* folder. By configuring this parameter (which can be different between heating and cooling if command communication objects are separated) to 0 K, the radiant panel and the fan coil work as two heating and/or cooling devices in parallel. Otherwise, if *Setpoint difference* > 0 K, the fan coil intervenes very quickly in the first tuning stages and leaves to the radiant panel the job of reaching the desired temperature.

## 10 Diagnostics

| Alarm code | Reason                                                       |
|------------|--------------------------------------------------------------|
| A01        | Room controller alarm                                        |
| A02        | Thermal generator lock alarm                                 |
| A03        | Internal temperature sensor alarm                            |
| A04        | Heating temperature limit alarm                              |
| Alarm code | Reason                                                       |
| E01        | Integrated temperature sensor failure                        |
| E02        | Integrated relative humidity sensor failure                  |
| E03        | CO: antistratification temperature sensor (from bus) failure |
| E04        | CO: outdoor temperature sensor (from bus) failure            |
| E05        | CO: coil temperature sensor (from bus) failure               |
| E06        | CO: floor surface temperature sensor (from bus) failure      |
| E07        | CO: flow temperature sensor (from bus) failure               |
| W01        | CO: integrated temperature sensor timeout                    |
| W02        | CO: integrated relative humidity sensor timeout              |
| W03        | CO: antistratification temperature sensor (from bus) timeout |
| W04        | CO: outdoor temperature sensor (from bus) timeout            |
| W05        | CO: coil temperature sensor (from bus) timeout               |
| W06        | CO: floor surface temperature sensor (from bus) timeout      |
| W07        | CO: flow temperature sensor (from bus) timeout               |
| W09        | CO: anticondensation sensor (from bus) timeout               |
| W10        | CO: window contact 1 timeout                                 |
| W11        | CO: window contact 2 timeout                                 |
| W12        | CO: presence sensor 1 timeout                                |
| W13        | CO: presence sensor 2 timeout                                |
| W14        | CO: card holder contact timeout                              |

Table 4 - Alarm and error codes

## 11 Warnings

- Installation, electrical connection, configuration and commissioning of the device can only be carried out by qualified personnel in compliance with the applicable technical standards and laws of the respective countries
- Opening the housing of the device causes the immediate end of the warranty period
- In case of tampering, the compliance with the essential requirements of the applicable directives, for which the device has been certified, is no longer guaranteed
- ekinex® KNX defective devices must be returned to the manufacturer at the following address: EKINEX S.p.A. Via Novara 37, I-28010 Vaprio d'Agogna (NO) Italy

## 12 Other information

- The present Application Manual is addressed to installers, system integrators and project engineers.
- For further information on the product, please contact the ekinex® technical support at the e-mail address: [support@ekinex.com](mailto:support@ekinex.com) or visit the website [www.ekinex.com](http://www.ekinex.com)
- Each ekinex® device has a unique serial number on the label. The serial number can be used by either installers or system integrators for documentation purposes and has to be added in each communication addressed to the EKINEX technical support in case of malfunctioning of the device
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