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CONTROL YOUR LIVING SPACE

Application Manual
EK-EM2-TP-E
KNX Clima Easy
room temperature controller

Contents

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Service	Modifications	Date	Drafted	Approved
1.0	First version	19/06/2026	G. Schiochet	V. Cappelli
1.1	Modified DPT 5.010 to “Customized” in Air conditioning management	27/07/2026	G. Schiochet	V. Cappelli
1.2	Modified alarm table	08/09/2026	G. Schiochet	V. Cappelli

The latest version of the user manual is available at www.ekinex.com. For previous versions, please contact technical support at support@ekinex.com.

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Introduction

This document describes the ekinex® KNX Clima Easy room thermostat with LCD display and Touch buttons, model EK-EM2-TP-E.

1 General information

The device described in this document functions as a digital electronic thermostat for controlling a room or a zone (consisting, for example, of a group of rooms or an entire floor) within a building and is therefore part of the secondary control system for the heating system. The thermostat has been developed in accordance with the KNX standard for use in home or building automation systems.

Using integrated sensors, the device can directly measure temperature and relative humidity values in the room, which can be used for the control and regulation of heating, cooling and ventilation systems. The device can also receive specific temperature values and information from other devices by acquiring data via the bus from external sensors.

The built-in display shows a range of information relating to the room thermostat function. The device is equipped with two physical inputs that can be configured independently as analogue or digital, allowing the basic functions to be extended to optimise comfort, safety and energy savings according to the individual needs of the user and/or the building. The unit can also indicate whether the room or zone is within a thermal comfort range that can be configured according to the building's intended use, the activity being carried out and other specific factors.

Finally, there are three specific applications for using the thermostat as an interface for air conditioning: Underfloor panel + split system, split system only, or as a simple on/off control for the unit.

1.1 Function

The main function of the unit is to control the temperature of the air mass in the room using the actual temperature (or T_{eff}), measured by the unit or received via the bus, and the setpoint temperature (or T_{set}) set by the user; by comparing these two values and using a series of parameters configured prior to commissioning, the device's algorithm calculates the value of the control variable, which is converted into a telegram and transmitted via the bus to KNX actuators (such as binary outputs, fan coil controllers, valve actuators, etc.) capable of controlling the operation of the heating and cooling units.

1.2 Main functional features

The main functions performed by the device are:

- measurement of temperature and relative humidity via integrated sensors, with the option to transmit the values over the bus;
- room temperature control using 2-point (ON/OFF) or proportional (PWM or continuous) regulation with a single setpoint;
- ventilation control with continuous or 3-speed adjustment;
- relative humidity control for humidification and dehumidification;
- operating modes: heating and cooling, with the option of switching locally or via the bus;
- interface applications for air conditioning (VRF): underfloor panel + split, split only or simple On/Off control;
- manual or automatic control of fan coil units with 2- or 4-pipe hydraulic supply;
- automatic switching of operating mode based on occupancy or window opening;
- weighted average of two temperature values;

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- display of temperature (measured, setpoint, perceived and outdoor in °C or °F), relative humidity (measured and setpoint in %), alarms and errors (with alphanumeric coding);
- window opening detection;
- calculation of psychrometric values (dew point and perceived temperature) with the option to transmit them via the bus;
- surface temperature limitation for underfloor heating systems;
- anti-condensation protection for underfloor and ceiling cooling systems;
- anti-stratification function;
- delayed fan coil fan start-up (“hot-start”), either timed or based on the fluid temperature measured at the heat exchanger coil;
- transmission via the bus of the status of the area being inside or outside the comfort zone (configurable);
- logic functions.

1.3 Technical data

Characteristic	Value
Device	KNX S-mode bus device
Communication	in accordance with the KNX TP1 standard
Application	dry indoor environments
Environmental conditions	• Operating temperature: - 5 ... + 45°C • Storage temperature: - 25 ... + 55°C • Transport temperature: - 25 ... + 70°C • Relative humidity: 95% non-condensing
Power supply	SELV 30 Vdc via KNX bus (no auxiliary power supply required)
Current draw from the bus	< 13 mA
Control elements	4 front-panel touch buttons for direct access to independent functions via a short press (< 3 s) and indirect access to other functions via a long press (> 3 s)
Programming controls	1 recessed programming button accessible on the right-hand side of the unit
Display controls	1 backlit LCD display, with buttons and icons
Temperature sensor	1 integrated NTC-type sensor
RH sensor	1 integrated
Completion	71 series faceplate (Deep or Form) or ERA (to be ordered separately)
Installation	Flush-mounted on a round or square flush-mounted box with a fixing hole centre-to-centre distance of 60 mm
Connection	• bus: black/red KNX terminal • inputs: screw terminals
Degree of protection	IP20
Dimensions (WxHxD)	60 x 60 x 35 mm

1.4 Design

The unit is designed for wall mounting on a round or square flush-mounted box with a fixing hole centre-to-centre distance of 60 mm. The pushbutton and the programming LED are located on the front panel, below the two buttons. The rear of the housing houses the 4-pole terminal block for connecting the 2 inputs and the terminal block for connecting the bus.

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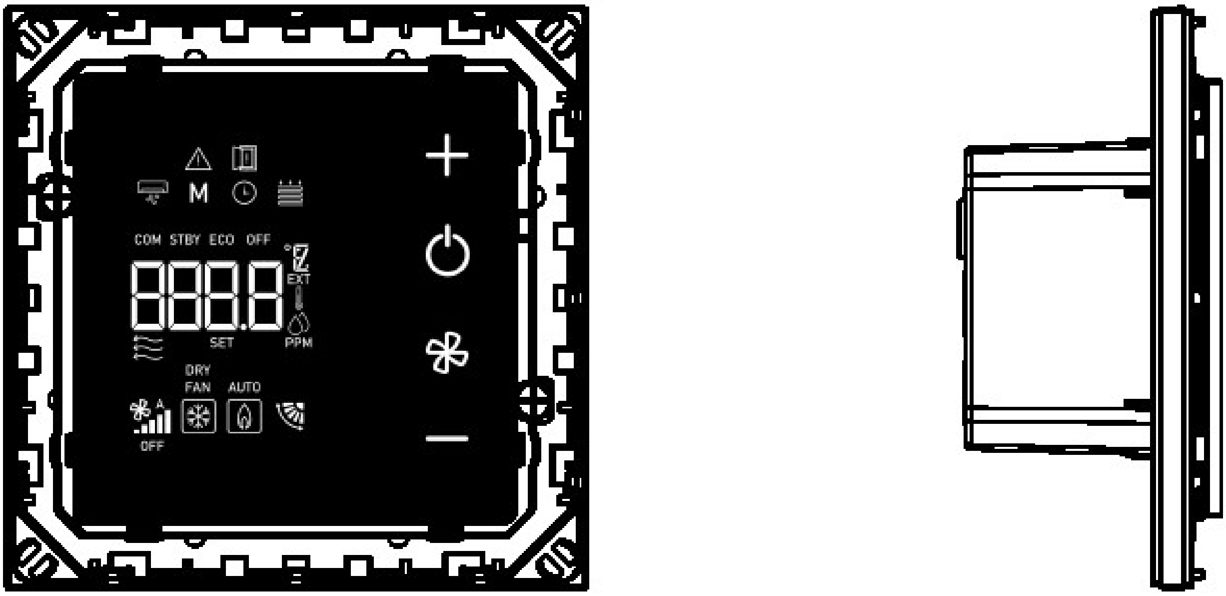

Figure 1 - Front and side view

1.5 Contents

The scope of supply includes the unit, the terminal block for connection to the KNX bus, the fixing screws (2 sets) and the metal bracket for mounting on the flush-mounted box. The packaging also contains the unit's instruction leaflet.

1.6 Accessories

The device can be fitted with a faceplate from the 71 series (Deep or Form) or the ERA series. Temperature sensors and any other devices to be connected to the inputs must be ordered separately.

1.7 Markings and certifications

The KNX mark guarantees the interoperability of the Ekinex thermostat with other KNX devices from Ekinex S.p.A. and other manufacturers installed on the same bus system. Compliance with the applicable European directives is certified by the CE mark.

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2 Installation

The device has an IP20 protection rating and is therefore suitable for use in dry indoor environments. To install the device, carry out the following steps:

a) secure the metal bracket supplied with the unit using the two screws to the wall-mounted flush-mounted box fitted with the appropriate holes. We recommend installing the unit at a height of 150 cm above the floor;
b) snap a 71 series (Deep or Form) or ERA faceplate into place, inserting it from the rear of the unit;
c) insert the bus terminal, previously connected to the bus cable, into the designated socket on the rear of the device. Connect the sensors (if fitted) to the device's inputs. At this point, it is recommended that you commission the device or, at the very least, download the physical address;
d) secure the device to the metal bracket supplied. To ensure the device is fitted correctly, the bus connection terminal must be positioned at the top left; when fitting, follow the TOP indication (arrow pointing upwards) on the back of the device.
e) Snap the control buttons into place.

The thermostat may only be fitted to a round or square flush-mounted box with fixing holes spaced 60 mm apart. If necessary, the metal mounting bracket for fitting to the flush-mounted box can also be ordered separately.

Note on fixing screws
The screws for the metal bracket must be tightened to a maximum torque of 1.0 Nm.

2.1 Connection

For the device to operate, it must be connected to the bus line and addressed, configured and commissioned using the ETS (Engineering Tool Software). The connection of one or two sensors to the inputs is optional and must be defined by the bus system designer.

2.1.1 Bus line connection

The device is connected to the bus line via the KNX terminal included in the supply, which is inserted into the designated socket on the rear of the device.

Features of the KNX terminal

- Spring-loaded conductor clamping
- 4 conductor slots for each polarity
- Suitable for KNX bus cable with single-core conductors with a diameter between 0.6 and 0.8 mm
- Recommended conductor stripping length: approx. 5 mm
- Colour coding: red = bus conductor + (positive), black = bus conductor – (negative)

2.1.2 Input connections

The inputs are connected via the screw terminals located on the rear of the unit. The maximum distance between the thermostat and the devices connected to the inputs is 10 m. Use a cable with a cross-section of no more than 1.5 mm² for the connection. The connection cable must be long enough to allow the unit to be removed from the flush-mounted box.

Terminal characteristics for configurable inputs

- Screw clamping of conductors
- Suitable for two-core stranded cable with a maximum cross-section of 1 mm²

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- Recommended conductor stripping length: approx. 5 mm
- Maximum torque 0.2 Nm

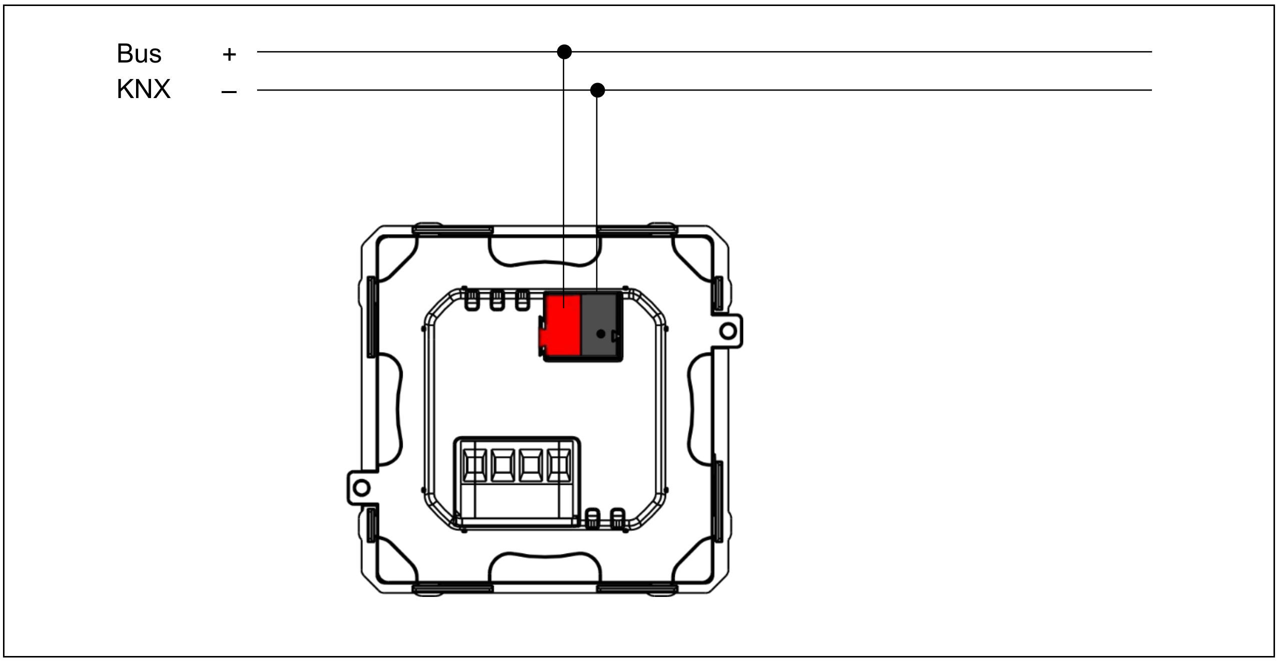

Figure 2 - Connecting the device to the bus line

3 Configuration and commissioning

Configuration and commissioning are carried out using the ETS (Engineering Tool Software) programme and the ekinex®application programme, which is provided free of charge by Ekinex S.p.A.; no additional software tools or plug-ins are required. For further information on ETS, please also visit www.knx.org.

3.1 Configuration

The device's functionality is determined by the settings configured via the software. Configuration requires at least ETS5 (or later versions) and the ekinex® APEKEM2TPE##.knxprod application programme (## = version), which can be downloaded from www.ekinex.com. The application programme allows you to access the configuration of all the device's operating parameters within the ETS environment. The application programme must first be loaded into ETS, after which all devices of the type in question can be added to the KNX bus system project. The configurable parameters for the device are described in detail later in this application manual.

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3.1.1 Application programme tree structure

Upon opening, the application programme's tree structure includes the following main items:

- Info EK-EM2-TP
- General
- Internal sensors
- Inputs
- External sensors (from bus)
- LCD display
- LED Touch
- Temperature control
- Energy saving
- Logic functions
- Relative humidity control
- Comfort

Other items may appear depending on the choices made for the parameters on the various tabs.

3.1.2 Application programme language

The application programme is available in four languages: Italian, English, German and French. The display language can be changed in ETS under 'Settings / Display language'.

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3.2 Commissioning

For commissioning, the device is equipped with:

- a recessed button on the right-hand side (2), when viewed from the front, for switching between normal operation and KNX programming modes; this button can be operated by pressing it with a pointed object from the right-hand side of the unit
- 4 LEDs below the touch buttons (3), which flash to indicate that programming mode is active.

Figure 3 - Programming: button (2) and Touch LEDs (3)

The following steps are required to commission the device:

- make the electrical connections as indicated above;
- apply power to the KNX bus
- switch the device to programming mode by pressing the recessed button located on the right-hand side of the device (when viewed from the front). In this operating mode, the LEDs on the touch buttons on the right-hand side will flash;
- download the physical address and configuration to the device using the ETS® programme. Whilst the application programme is being downloaded, the display shows ‘PrOg’ and a flashing clock symbol.

Once the download is complete, the device automatically returns to normal mode; in this mode, the backlit touch-button LEDs remain lit steadily. The bus device is now programmed and ready for operation.

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4 User interface

The thermostat's user interface consists of a backlit LCD display (1) and 4 touch LEDs for programming functions and adjusting certain parameters.

Figure 4 - User interface: display (1) and backlit touch LEDs (2)

The symbols displayed on the LEDs indicate the function being performed:

 temperature increase (or setpoint)

 Thermostat on/off

 Fan speed setting

 temperature decrease (or setpoint)

A change to the temperature setpoint is confirmed after a 3-second delay without any further touches on the touch buttons ('Auto-confirmation'). When the set value stops flashing, the change to the setpoint has been accepted.

4.1 LCD display

The unit is fitted with an LCD display (1) with adjustable backlighting, which occupies a vertical area of approximately 25 x 45 mm (WxH) on the left-hand side of the unit.

4.1.1 Information display

Depending on the configuration via ETS, the connections and the availability of information (local or received via bus), the series of symbols on the display shows:

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- actual room temperature (which may be understood as the room temperature calculated as a weighted average of two values);
- standard (hydronic) or VRF application;
- thermostat on (COM) or off (OFF);
- outdoor temperature (preceded by a – sign for sub-zero outdoor temperatures);
- relative humidity in the room (in %, without decimals);
- setpoint temperature;
- alarm and error conditions (using codes A01, A02… E01, E02…);
- whether the window(s) in the room are open;
- heating/cooling mode of the heating system;
- thermostat status: request or satisfied (or setpoint not reached);
- fan coil fan status (1-2-3-automatic-off), where configured.

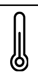
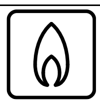
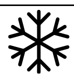
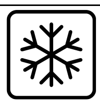
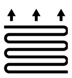
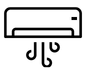
Display symbols			
888.8	Digits (display of numerical values)	COM	Thermostat operational
°C	Celsius degrees	OFF	Thermostat off
°F	Fahrenheit	DRY	Dehumidification control mode
%	Percentage (relative humidity)	FAN	Ventilation control mode
SET	View or change temperature setpoint	AUTO	Automatic control mode
	Temperature display (measured value or setpoint)		Active heating mode (thermostat satisfied or setpoint reached)
	Relative humidity display		Heating operation mode active (thermostat calling or setpoint not reached)
	Alarm present		Active cooling mode (thermostat satisfied or setpoint reached)
	Window open		Active cooling mode (thermostat in call or setpoint not reached)
	Standard application (hydronic system)		Ventilation operation (off, automatic, speeds 1, 2, 3)
	AC application (VRF)		Application download in progress (flashing icon), accompanied by the text “PrOg”.

Figure 5 - Symbols that can be displayed on the LCD screen

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4.1.2 Display test

The display test is carried out automatically every time the device is restarted. All segments and icons on the display light up for approximately 4 seconds. Once this time has elapsed, the device resumes normal operation.

4.1.3 Backlight

The brightness of the LCD display and touch keys can be set independently via ETS. The brightness of the touch keys can also be dynamically adjusted via the KNX bus.

For both parameters, it is also possible to set different values to be applied during energy-saving mode, i.e. when the user does not interact with the display interface for a pre-set period of time.

5 Sensors

The thermostat is equipped with two sensors in a single integrated component

- Temperature;
- relative humidity.

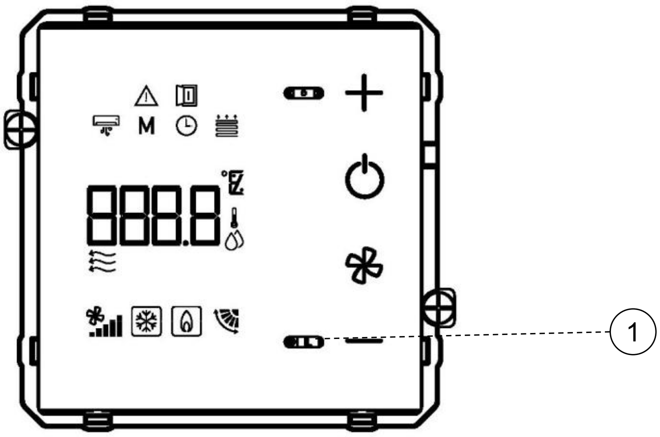

Figure 6 - Sensor locations: temperature and relative humidity (1)

5.1 Temperature sensor

The built-in temperature sensor measures the room temperature within the range of 0 °C to +40 °C with a resolution of 0.1 °C. To account for significant environmental interference, such as proximity to heat sources, installation on an external heat-dissipating wall, or the chimney effect caused by warm air rising through the corrugated conduit connected to the flush-mounted box, the measured value can be corrected by an offset of ± 5 °C or, preferably, a weighted average of two temperature values selected from the following can be used: the value measured by the built-in sensor, the value measured by a temperature sensor connected to one of the device’s inputs, or the value received via the bus from another KNX device (e.g. from ekinex push-buttons).

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5.1.1 Temperature display in Fahrenheit or Celsius

The display interface can show the temperature or setpoint in degrees Fahrenheit or Celsius, depending on the setting in ETS.

The 'Reference temperature step' parameter is expressed in °C regardless of whether the display is in °C or °F.

As a change of 1 °C is equivalent to a change of 1.8 °F, the correspondence of the reference temperature step is shown in the following table:

Change in °C	Change in °F
0.1	0.5
0.2	0.5
0.5	1
1	2

Figure 7 - Correspondence between temperature changes in °C and °F

5.2 Relative humidity sensor

The built-in relative humidity sensor measures the relative humidity in the room. The measured value enables advanced temperature control of the room and extends the safe operating range of certain types of terminal units used in cooling systems. It can also be calibrated via ETS using an offset of ± 10 %.

The measured value can also be sent over the bus via Communication Objects 14 (1-byte) and 15 (2-byte). Through a calculation performed by the thermostat, psychrometric values obtained from the combined measurement of temperature and humidity – such as dew point and perceived temperature (summer mode only) – can also be sent over the bus.

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6 Input variables

The data that the device uses in its control algorithms and/or for display on the screen may come from:

- internal sensors within the device;
- from sensors or digital signals connected to the device's two physical inputs;
- from the KNX bus via standard Communication Objects.

The processed data can also be transmitted over the KNX bus as Communication Objects. The classification of input variables is shown in the table below.

Data	Source	Description
Room temperature	Internal sensors	Analogue value for temperature control functions
Relative room humidity		Analogue value for temperature control functions
Window status (open/closed)	Input 1 or 2 (thermostat terminal block) configured	[DI] window open contact
Card holder status (card present/absent)		[DI] card holder contact
Condensation detected		[DI] anti-condensation sensor
Heat transfer fluid temperature at the heat exchanger		[AI] heat exchanger coil temperature sensor
Room temperature (weighted average)		[AI] room temperature sensor
Room temperature (other measurement point)		[AI] anti-stratification temperature sensor
Floor surface temperature		[AI] floor surface temperature sensor
Outdoor temperature		[AI] external temperature sensor
Other temperature value		[AI] generic NTC temperature sensor
Room temperature	KNX bus (via communication objects)	Object 34 (2 bytes)
Relative room humidity		Objects 35 (2 bytes) and 36 (1 byte)
Anti-stratification temperature		Object 37 (2 bytes)
Outdoor temperature		Object 38 (2 bytes)
Heat exchanger coil temperature		Object 40 (2 bytes)
Floor surface temperature		Object 41 (2 bytes)
Heat transfer fluid flow temperature		Object 42 (2 bytes)
Condensation present		Object 46 (1 bit)
Window status (open/closed)		Objects 43 and 44 (1 bit)
Card holder status (card present/absent)		Object 45 (1 bit)

Figure 8 - Input variables from internal sensors, standard inputs and communication objects

The device does not have outputs for the direct control of heating/cooling terminals or for signalling statuses and values. The output variables consist exclusively of communication objects that are sent over the bus, received and processed by KNX actuators (generic or dedicated to HVAC applications).

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7 Air conditioning applications

As an alternative to the standard hydronic system application, the thermostat allows you to configure the operation of three air conditioning (AC) applications via ETS.

These applications can be selected from the drop-down menu in the *Temperature Control* tab, provided that Thermostat Function has been set to heating and cooling.

The applications are listed under the *Settings – Air conditioning application* parameter and are:

- Underfloor panel + split
- Split only
- Simple On/Off

The temperature setpoint and fan speed settings for any of the AC applications are configured using the same procedures as those described for the hydronic interface.

7.1 Underfloor panel + split

This application is enabled by selecting "Underfloor panel + split" from the drop-down menu in the *Temperature Control* tab, under the *Settings – Air conditioning application* parameter in the ETS application.

It is used where there is a radiant system in which the operating mode (heating or cooling) is set via the KNX bus.

Specifically:

- In heating mode, a radiant panel terminal is used, combined with a low-inertia split system;
- In cooling mode, only the split system is used.

Once the application has been enabled via ETS, the switch from the standard interface to the AC interface is made by pressing the ‘ ’ touch button for at least 3 seconds. This interface is indicated by the ‘ ’ icon.

To return to the standard interface, press the ‘ ’ touch button again for at least 3 seconds.

In this application, the ETS software displays the ‘Air Conditioning’ tab under ‘Temperature Control’.

In the ‘Ventilation’ tab, you can select the control type, the communication object, the fan speed values and other user-configurable settings, as described in the section 8.8.4.

In the "Air Conditioning" tab, you can select the data type for the control mode, if necessary entering the value to be sent to the fan unit to activate it.

Since in this application the operating mode (heating or cooling) is set by the bus via communication object *49 – Heating/Cooling status in*, the available control modes (which can be selected from the display interface by pressing in sequence the touch button are:

- **Off;**
- **Heating or Cooling**, depending on the operating mode;
- **Ventilation (Fan);**
- **Dehumidification (Dry).**

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7.2 Only split

This application is enabled by selecting “Only split” from the drop-down menu in the *Temperature Control* tab, under the *Settings – Air conditioning application* parameter in the ETS application.

This is used if the only terminal in the system is a direct expansion system, i.e. a vapour compression system.

The AC interface is immediately visible on the display and is indicated by the icon .

The “Ventilation” and “Air Conditioning” tabs are structured in the same way as for the “Underfloor panel + split” interface.

The available control modes (which can be selected from the display interface by pressing the touch button in sequence) are:

- **Off;**
- **Auto;**
- **Heating;**
- **Cooling;**
- **Ventilation (Fan);**
- **Dehumidification (Dry).**

7.3 Simple On/Off

This application is enabled by selecting “Simple On/Off” from the drop-down menu in the *Temperature Control* tab, under the *Settings – Air conditioning application* parameter in the ETS application.

This is a split application in which the user does not select the control mode, as this is set via an external unit. The user can only switch the control mode set via the KNX bus to On or Off.

The AC interface is immediately visible on the display and is indicated by the icon .

The ‘Ventilation’ and ‘Air Conditioning’ tabs are structured in the same way as for the ‘Underfloor panel + split’ interface.

The available control modes (which can be selected from the display interface by pressing the touch button in sequence) are:

- **Off;**
- **Heating or Cooling**, depending on the mode set via the KNX bus using communication object *74 – AC enable in*.

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8 ETS Application programme

The following chapters contain a list of the tabs, parameters and communication objects present in the application programme. Some specific functions of the thermostat are described in greater detail in the relevant sections. The main tree structure of the application programme, when imported into ETS (or by pressing the 'Default parameters' button in ETS), appears as follows:

- Info EK-EM2-TP
- General
- Internal sensors
  - Temperature sensor
  - Relative humidity sensor
- Inputs
- External sensors (from bus)
- LCD display
- LED Touch
- Temperature control
  - Settings
  - Heating
- Energy saving
  - Window contacts
  - Card holder
- Logic functions
- Relative humidity control
- Comfort

Other tabs may appear depending on the choices made for the parameters of the tabs shown in the main tree structure.

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8.1 Info EK-EM2-TP

The ***'Info EK-EM2-TP'*** tab is for information purposes only and does not contain any parameters to be set. The information provided is:

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Application software for ETS5 & ETS6
Version 1.00 (or later)
EK-EM2-TP – KNX Clima room temperature controller with LC-display

Ekinex S.p.A.
Via Novara, 37
I-28010 Vaprio d'Agogna (NO) Italy
www.ekinex.com
info@ekinex.com

8.1.1 General

The ***General*** tab contains the following parameters:

- Product type
- Temperature displayed unit
- Setpoint temperature step
- Default displayed information
- Delay after bus voltage recovery
- Logic functions

The card has no secondary cards.

8.1.2 Parameters

Parameter name	***Conditions***	***Values***
Product type		**-----** EK-EM2-TP-E
	Before downloading the ETS application, you must select the product type (only 1 available).	
Temperature displayed unit		**Celsius** Fahrenheit
Setpoint temperature step		0.1 °C 0.2 °C **0.5 °C** 1 °C
	See section 5.1.1 .	
Default displayed information		**actual temperature** temperature setpoint
	The actual temperature is the value on the basis of which the unit regulates the climate. It may be the value detected by a single sensor (internal, from the bus or from an input) or the weighted average of the temperatures detected by a main sensor and an additional sensor. *The setpoint temperature displayed is that of the control mode currently set on the thermostat (as indicated by the active icon).*	

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Parameter name	Conditions	Values
Delay after bus voltage recovery		**00:00:04.000 hh:mm:ss:fff** [range 00:00:04.000 … 00:10:55.350]
	The time interval after which the transmission of telegrams on the bus begins following the restoration of power. This delay applies to both the transmission of a telegram upon the occurrence of an event and cyclic transmission. In the case of cyclic transmission, the countdown for the retransmission pause begins at the end of the initial delay period. *The field is formatted as hh:mm:ss:fff (hours : minutes : seconds . milliseconds): the default value 00:00:04.000 therefore corresponds to 4 seconds.*	
Logic functions		**disabled** Enabled
	Enables the tab for configuring 8-channel AND, OR and XOR logic functions (4 inputs per channel)	

Object name	Conditions	Dim.	Flags	DPT	No. of Comm. Objects
Rockers lock	-	1 Bit	C-W--	[1.003] Enable	101
	Allows you to disable the Touch keys.				
Thermal generator lock	-	1 Bit	C-W--	[1.005] Alarm	102
	Alarm triggered following a shutdown of the heat generator.				
Alarm x (from bus) x = 1, 2, 3, 4	-	1 Bit	C-W--	[1.005] Alarm	103, 104, 105, 106.
	Allows you to configure up to 4 alarm signals that can be sent via the bus.				

Information displayed by default

One of the two values – either *the actual temperature* or *the temperature setpoint* – is displayed by default. In ETS, you can configure the display to show two screens, alternating every 7 seconds (‘carousel’). Specifically:

- Screen 1: room temperature, or temperature setpoint;
- Screen 2: relative humidity

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8.2 Internal sensors

The ***Internal Sensors*** tab contains the following parameters:

- Temperature sensor
- Relative humidity sensor

8.2.1 Parameters

Parameter name	Conditions	Values
Temperature sensor		**enabled** disabled
	The temperature sensor is enabled by default. *Disabling the sensor causes the secondary tab to disappear from the main application tree; in this case, to make the Temperature Control functions available again, you must enable Room Temperature in the External Sensors (from bus) tab or Input X = [AI] room temperature sensor (X = 1, 2) in the Inputs tab.*	
Relative humidity sensor		**enabled** disabled
	The relative humidity sensor is disabled by default. When the sensor is disabled, functions requiring the value of this parameter can still be accessed by enabling 'Relative Humidity' in 'External Sensors (from the bus)'. *Enabling the sensor causes the secondary tab to appear in the main tree structure of the application.*	

8.2.2 Temperature sensor

The ***Temperature Sensor*** sub-tab appears only if the corresponding sensor is enabled in the ***Internal Sensors*** tab and contains the following parameters:

- Filter type
- Temperature offset
- Minimum change of value to send [K]
- Cyclic sending interval
- Threshold 1
- Threshold 2

8.2.2.1 Communication parameters and objects

Parameter name	Conditions	Values
Filter type	Temperature sensor = enabled	low **medium** High
	Low = average value every 4 measurements *Medium = average value every 16 measurements* *High = average value every 64 measurements*	
Temperature offfset	Temperature sensor = enabled	**0°C** [range -5°C … +5°C]
	Allows an offset to be applied to the temperature value measured by the sensor	
Minimum change of value to send [K]	Temperature sensor = enabled	**0.5** [range 0 … 5]
	If the parameter is set to 0, no value is sent when the setting is changed.	

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Parameter name	*Conditions*	*Values*
Cyclic sending interval	Temperature sensor = enabled	**no sending** [other values in the range 30 s … 120 min]
Threshold 1	Temperature sensor = enabled	**not active** below above
Value [°C]	Temperature sensor = enabled, Threshold 1 = below or above	**7** [range 0 … 50]
Threshold 2	Temperature sensor = enabled	**not active** below above
Value [°C]	Temperature sensor = enabled, Threshold 2 = below or above	**45** [range 0 … 50]
Hysteresis	Temperature sensor = enabled, Threshold 1 and/or Threshold 2 = below or above	**0.4 K** [other values between 0.2 K and 3 K]
Cyclic sending interval	Temperature sensor = enabled, Threshold 1 and/or Threshold 2 = below or above	**no sending** [other values in the range 30 s … 120 min]

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Temperature value	Temperature sensor = enabled	2 bytes	CR-T-	[9.001] temperature (°C)	3
Temperature threshold 1 – Switch	Temperature sensor = enabled, Threshold 1 = below or above	1 bit	CR-T-	[1.001] switch	16
Temperature threshold 2 – Switch	Temperature sensor = enabled, Threshold 2 = below or above	1 Bit	CR-T-	[1.001] switch	17

Acquisition filter

The acquisition filter calculates an average of a series of acquired values of the measured quantity before sending them to the bus. The parameter can take the following values:

- low (average value calculated every 4 measurements);
- medium (average value calculated every 16 measurements);
- high (average value calculated every 64 measurements).

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Measured temperature correction

The temperature value is sampled (approximately) every 10 seconds, whilst the display is updated every minute. During configuration with ETS, it is possible to correct the measured temperature value within an offset range of −5°C to +5°C (in 0.1 K increments).

8.2.3 Relative humidity sensor

The ***Relative Humidity Sensor*** tab appears only if the corresponding sensor is enabled in the ***Internal Sensors*** tab and contains the following parameters:

- Filter type
- Humidity offset
- Minimum change of value to send [%]
- Cyclic sending interval
- Threshold 1
- Threshold 2

For the individual parameters, the guidelines provided for the corresponding parameters of the temperature sensor apply.

Correction of measured relative humidity

The relative humidity sensor data sheet includes a value correction (offset) parameter: during configuration with ETS, it is possible to correct the measured relative humidity value within the offset range of –10% to +10% (in 1% increments).

The humidity sensor used is factory-calibrated.

8.2.3.1 Parameters and communication objects

Parameter name	***Conditions***	***Values***
Filter type	Relative humidity sensor = enabled	low **medium** High
	Low = average value every 4 measurements *Medium = average value every 16 measurements* *High = average value every 64 measurements*	
Humidity offset	Relative humidity sensor = enabled	**0 %** [range -10 % … +10 %]
	Allows an offset to be applied to the relative humidity value measured by the sensor	
Minimum change of value to send [%]	Relative humidity sensor = enabled	**2** [range 0 … 10]
	If the parameter is set to 0, no value is transmitted when a change occurs.	
Cyclic sending interval	Relative humidity sensor = enabled	**no sending** [other values in the range 30 s … 120 min]
Threshold 1	Relative humidity sensor = enabled	**not active** below above
Value [%]	Relative humidity sensor = enabled, Threshold 1 = below or above	**65** [range 0 … 100]

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Parameter name	***Conditions***	***Values***
Threshold 2	Relative humidity sensor = enabled	**not active** below above
Value [%]	Relative humidity sensor = enabled, Threshold 2 = below or above	**65** [range 0 … 100]
Hysteresis [%]	Temperature sensor = enabled, Threshold 1 and/or Threshold 2 = below or above	**3.0 %** [other values in the range 0.5 … 4.0 %]
	The value of the Hysteresis parameter is common to both Threshold 1 and Threshold 2.	
Cyclic sending interval	Temperature sensor = enabled, Threshold 1 and/or Threshold 2 = below or above	**no sending** [other values in the range 30 s … 120 min]
	The value of the 'Cyclic sending interval' parameter is common to both Threshold 1 and Threshold 2.	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. objects***
Humidity value (1 byte)	Relative humidity sensor = enabled	1 byte	CR-T-	[5.001] percentage (0..100%)	14
Humidity value (2 bytes)	Relative humidity sensor = enabled	2 bytes	CR-T-	[9.007] percentage (%)	15
Humidity threshold 1 – Switch	Relative humidity sensor = enabled, Threshold 1 = below or above	1 Bit	CR-T-	[1.001] switch	18
Humidity Threshold 2 – Switch	Relative humidity sensor = enabled, Threshold 2 = below or above	1 Bit	CR-T-	[1.001] switch	19

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8.3 Inputs

The ***Inputs*** tab allows you to configure one or two variables (either digital or analogue) based on devices or sensors connected to the room thermostat's input terminals. The physical quantities or states acquired can be used locally by the thermostat for temperature control functions and/or transmitted over the bus for other purposes. The tab contains the parameters for configuring input 1 and input 2 independently. The two inputs are identical; for simplicity, the parameters and communication objects for a single input are described below.

8.3.1 Input x

The ***Input x*** (x = 1, 2) card contains the following parameters:

- Input x
- Contact type
- Filter type
- Measured temperature correction
- Usage
- Transmission to the bus
- Transmission interval
- Minimum variation to be sent to the bus (K)
- Threshold 1
- Value [°C]
- Threshold 2
- Value [°C]
- Hysteresis
- Cyclic sending interval

8.3.2 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Input x		**disabled** [DI] window opening contact [DI] card holder pocket contact [DI] anti-condensation sensor [AI] heat exchanger coil temperature sensor [AI] room temperature sensor [AI] anti-stratification temperature sensor [AI] floor surface temperature sensor [AI] outdoor temperature sensor [AI] General-purpose NTC temperature sensor
	The prefix [DI] indicates a digital input; the prefix [AI] indicates an analogue input.	
Contact type	Input X = [DI] …	**NO (normally open)** NC (normally closed)
	This parameter is always available when the input is configured as digital.	
Debouce time	Input X = [DI] …	**00:00:00.200 hh:mm:ss.fff** [range from 00:00:00.000 to 00:10:55.350]
	This parameter is always available when the input is configured as digital. The field is formatted as hh:mm:ss:fff (hours : minutes : seconds . milliseconds): the default value 00:00:00.200 therefore corresponds to 200 milliseconds.	

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Parameter name	*Conditions*	*Values*
Filter type	Input X = [AI] …	low **medium** high
	This parameter is always available when the input is configured as analogue. Settable values: Low = average value every 4 measurements Medium = average value every 16 measurements High = average value every 64 measurements	
Temperature offset	Input X = [AI] …	**0°C** [range −5°C … +5°C]
	This parameter is always available when the input is configured as analogue.	
Minimum change of value to send [K]		**0.5** [range 0 to 5]
	This parameter is always available when the input is configured as analogue. If set to 0, no value is transmitted upon a change.	
Cyclic sending interval	Input X = other than disabled	**no sending** [other values in the range 30 s … 120 min]
Threshold 1	Input X = [AI] …	**not active** below above
	This parameter is always available when the input is configured as analogue.	
Value [°C]	Input X = [AI] … Threshold 1 = below or above	**7** [range from 0 to 50]
Threshold 2	Input X = [AI] …	**not active** below above
	This parameter is always available when the input is configured as analogue.	
Value [°C]	Input X = [AI] … Threshold 2 = below or above	**45** [range from 0 to 50]
Hysteresis	Input X = [AI] … Threshold 1 = below or above Threshold 2 = below or above	**0.4 K** [other values in the range 0.2 K … 3 K]
Cyclic sending interval	Input X = [AI] … Threshold 1 = below or above Threshold 2 = below or above	**no sending** [other values in the range 30 s … 120 min]

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Window contact sensor (from input 1)	Input 1 = [DI] windows contact sensor	1 bit	CR-T-	[1.019] window/door	26
Window contact sensor (from input 2)	Input 2 = [DI] windows contact sensor	1 bit	CR-T-	[1.019] window/door	27
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Anticondensation sensor (from input 1)	Input 1 = [DI] anticondensation sensor	1 Bit	CR-T-	[1.005] alarm	28

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Anticondensation sensor (from input 2)	Input 2 = [DI] anticondensation sensor	1 bit	CR-T-	[1.005] alarm	29
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Card holder contact sensor (from input 1)	Input 1 = [DI] card holder contact sensor	1 Bit	CR-T-	[1.018] occupancy	30
Card holder contact sensor (from input 2)	Input 2 = [DI] card holder contact sensor	1 bit	CR-T-	[1.018] occupancy	31
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Coil battery temperature sensor (from input 1)	Input 1 = [AI] coil battery temperature sensor	2 bytes	CR-T-	[9.001] temperature (°C)	20
Coil battery temperature sensor (from input 2)	Input 2 = [AI] coil battery temperature sensor	2 bytes	CR-T-	[9.001] temperature (°C)	23
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Room temperature sensor (from input 1)	Input 1 = [AI] room temperature sensor	2 bytes	CR-T-	[9.001] temperature (°C)	20
Room temperature sensor (from input 2)	Input 2 = [AI] room temperature sensor	2 bytes	CR-T-	[9.001] temperature (°C)	23
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Antistratification temperature sensor (from input 1)	Input 1 = [AI] antistratification temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	20
Antistratification temperature sensor (from input 2)	Input 2 = [AI] antistratification temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	23
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Floor surface temperature sensor (from input 1)	Input 1 = [AI] floor surface temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	20
Floor surface temperature sensor (from input 2)	Input 2 = [AI] floor surface temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	23
	Note: if both inputs are configured in the same way, only the first one is used by the unit.				
Outdoor temperature sensor (from input 1)	Input 1 = [AI] outdoor temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	20
Outdoor temperature sensor (from input 2)	Input 2 = [AI] outdoor temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	23
	Note: if both inputs are configured in the same way, only the first one is used by the unit .				
Temperature value sensor (from input 1)	Input 1 = [AI] generic (NTC) temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	20
Temperature value sensor (from input 2)	Input 2 = [AI] generic (NTC) temperature sensor	2 bytes	CR-T-	[9.001] temperature °C	23
	Note: if both inputs are configured in the same way, only the first one is used by the device.				
Temperature threshold 1 sensor 1 – Switch	Input 1 = [AI] … Threshold 1 = below or above	1 Bit	CR-T-	[1.001] switch	21

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Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. objects***
Temperature threshold 2 sensor 1 – Switch	Input 1 = [AI] … Threshold 2 = below or above	1 Bit	CR-T-	[1.001] switch	22
Temperature threshold 1 sensor 2 – Switch	Input 2 = [AI] … Threshold 1 = below or above	1 Bit	CR-T-	[1.001] switch	24
Temperature threshold 2 sensor 2 – Switch	Input 2 = [AI] … Threshold 2 = below or above	1 Bit	CR-T-	[1.001] switch	25

8.4 External sensors (from bus)

'External sensors' refers to KNX devices (or conventional sensors interfaced to the bus via KNX devices) that send statuses or values to the thermostat via the bus. Enabling an external sensor without connecting the corresponding communication object triggers a permanent alarm on the display and suspends the temperature control function.

The ***External Sensors (from the bus)*** tab contains the following parameters:

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

The card has no secondary cards.

8.4.1 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Room temperature		**disabled** / enabled
	Enables a temperature bus sensor to perform the anti-stratification function.	
Antistratification temperature		**disabled** / enabled
	Enables a temperature bus sensor to perform the anti-stratification function.	
Outdoor temperature		**disabled** / enabled
	Enables an external temperature bus sensor to display the measured value on the unit's display. This data acquisition is an alternative to that via a sensor connected to one of the unit's inputs: this parameter only appears if the external temperature sensor has not been enabled in the Inputs tab.	

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Parameter name	*Conditions*	*Values*
Coil temperature		**disabled** / enabled
	Enables a bus sensor to measure the temperature of the heat transfer fluid at the heat exchanger. Reading this value enables the fan's hot-start function.	
Floor surface temperature		**disabled** / enabled
	Enables a bus sensor to measure the surface temperature of a heated floor. Acquiring this value enables the surface temperature limitation function.	
Flow temperature		**disabled** / enabled
	Enables a bus sensor to measure the flow temperature of the heat transfer fluid. Acquiring this value allows the dew point temperature to be calculated and enables the active anti-condensation protection function in surface cooling systems (floor or ceiling).	
Analog sensors timeout		**00:05:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	The field is formatted as hh:mm:ss (hours : minutes : seconds): the default value 00:05:00 therefore corresponds to a 5-minute timeout. The value 00:00:00 means that the analogue sensor timeout is disabled.	
Anticondensation		**disabled** / enabled
	Enables a bus sensor to detect condensation.	
Window contact 1		**disabled** / enabled
	Enables a bus sensor to detect whether a window or door is open or closed.	
Signal		**not inverted** inverted
	Allows you to select whether the signal type of the window contact 1 is inverted or not.	
Window contact 2		**disabled** / enabled
	Enables a bus sensor to detect whether a window or door is open or closed.	
Signal		**not inverted** inverted
	Allows you to select whether the signal type of the window contact 2 is inverted or not.	
Card holder contact		**disabled** / enabled
	Enables a bus sensor to detect the presence or absence of people within the room.	
Digital sensor timeout		**00:05:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	The field is formatted as hh:mm:ss (hours : minutes : seconds): the default value 00:05:00 therefore corresponds to a 5-minute timeout. The value 00:00:00 means that the digital sensor timeout is disabled.	

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Room temperature (from bus)	Enabled	2 bytes	C-W--	[9.001] temperature (°C)	34
Antistratification temperature (from bus)	enabled	2 bytes	C-W--	[9.001] temperature (°C)	37
Outdoor temperature (from bus)	enabled	2 bytes	C-W--	[9.001] temperature °C	38
Coil temperature (from bus)	enabled	2 bytes	C-W--	[9.001] temperature (°C)	40

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Object name	Conditions	Dim.	Flags	DPT	No. of Comm. objects
Floor temperature (from bus)	enabled	2 bytes	C-W--	[9.001] temperature (°C)	41
Flow temperature (from bus)	enabled	2 bytes	C-W--	[9.001] temperature (°C)	42
Anticondensation (from bus)	enabled	1 bit	C-W--	[1.001] switch	46
Window contact sensor 1 (from bus)	enabled	1 bit	C-W--	[1.019] window/door	43
Window contact sensor 2 (from bus)	enabled	1 bit	C-W--	[1.019] window/door	44
Contact of card holder (from bus)	enabled	1 bit	C-W--	[1.001] switch	45

Note on sensor time-out

The thermostat's internal control system cyclically monitors the update status of external sensor values (from the bus) and inputs once the set timeout value has elapsed. If no value update is received, the control function is suspended. The alarm is indicated on the display by the symbol and the corresponding alarm code (see also the list of alarms in the Diagnostics section).

8.5 Weighted temperature value

The ***'Weighted temperature value'*** tab appears only if at least two sensors for measuring room temperature are enabled; for example, the internal sensor and the external room temperature sensor from the bus, or the [AI] room temperature sensor input.

It contains the following parameters:

- Main source for temperature value
- Additional source temperature value
- Relative weighting
- Minimum change of value to send [K]
- Cyclic sending interval

8.5.1 Communication parameters and objects

Parameter name	Terms and Conditions	Values
Main source for temperature value	-	**Internal sensor** from bus (*)
	(*) The values that can be set depend on whether the internal sensor, the inputs and the external sensors (from bus) are enabled.	
Additional source temperature value	-	**Internal sensor** from bus (*)
	(*) The values that can be set depend on whether the internal sensor, the inputs and the external sensors (from bus) are enabled.	

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Parameter name	Terms and Conditions	Values
Relative weight		100% main sensor 90% / 10% 80% / 20% 70% / 30% 60% / 40% **50% / 50%** 40% / 60% 30% / 70% 20% / 80% 10% / 90% 100% additional sensor
Minimum change of value to send [K]		**0.5** [other values in the range 0 … 5 K]
	If the parameter is set to 0, no value is transmitted upon a change.	
Cyclic sending interval		**no sending** [other values in the range 30 s … 120 min]

Object name	Conditions	Dim.	Flags	DPT	No. of Comm. objects
Weighted temperature	At least 2 room temperature sensors enabled (internal, from input or from external sensor)	2 bytes	CR-T-	[9.001] temperature °C	47

Note on weighted temperature

The thermostat allows the room temperature to be measured in three ways:

1) from the temperature sensor built into the unit;
2) from an external temperature sensor connected to an input on the device configured as analogue (Inputs⇒ Input 1 or 2 = [AI] room temperature sensor);
3) via the bus from another KNX device, for example from an ekinex push-button [External sensors (from the bus)⇒ Room temperature = enabled];

To optimise or correct the room temperature control in specific situations (in large rooms, where there is significant asymmetry in temperature distribution, when the thermostat is installed in an unsuitable position, etc.), the device can therefore use a weighted average of two temperature values. The weights are assigned via the *‘Relative Weight’* parameter, which assigns a proportion to the two values.

8.6 LCD Display

The ***LCD Display*** tab contains the following parameters:

- Backlight intensity
- Energy saving
- Visualization type
- Time before energy saving mode
- Backlight when in energy saving mode
- Behaviour on button press

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- Actual temperature
- Relative humidity

Energy-saving mode

After a configurable period of time, the thermostat switches from the normal display to the energy-saving display. In this display mode:

- the intensity of the backlight can be reduced;
- the amount of information displayed can be reduced. There are two options: full (i.e. the same information as in normal display mode) or temperature only.

To exit energy-saving mode, press any of the Touch buttons, which will restore the normal display.

Backlight

The display's default backlight can be configured according to the installation location and ambient light conditions during use. The backlight intensity can be set to a fixed value (in %).

Information to be displayed

In energy-saving mode, the actual temperature or the temperature setpoint is always shown on the display; in addition, relative humidity can also be displayed in sequence ('carousel'), as in normal mode.

8.6.1 Parameters

Parameter name	***Conditions***	***Values***
Backlight intensity		10% / 20% / 30% / 40% / **50%** / 60% / 70% / 80% / 90% / 100%
Energy saving		**disabled** / enabled
	If the Energy saving setting is set to 'enabled', after a certain period of time the device automatically reduces the backlight brightness and, where applicable, the information displayed.	
Visualization type	Energy saving = enabled	**Full** Temperature only
	In addition to the figures, the temperature-only display includes the symbol (°C or °F).	
Time before energy saving mode	Energy saving = enabled	**10 s** / 15 s / 30 s 45 s / 1 min
Backlight when in energy saving mode	Power saving = enabled	off / 2% / 5% / 10% / 15% / 20% / **25%** / 30%
Behaviour on button press	Energy saving = enabled	**backlight only** / backlighting and button function
	Defines the device's response when a Touch button is pressed for the first time whilst in energy-saving mode.	
Actual temperature	A temperature sensor enabled (internal, external via the bus, via input)	**always enabled**
	Displays the actual temperature or the temperature setpoint, depending on the settings in the General tab.	

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Parameter name	*Conditions*	*Values*
Relative humidity	At least one relative humidity sensor enabled (internal or external via the bus)	disabled **enabled**

8.7 LED Touch

The device is fitted with four LED-backlit touch buttons.

The ***LED*** panel displays the following parameters:

- LEDs intensity from bus
- LED intensity
- LED intensity during energy saving
- Signal from the bus
- Technical alarm

8.7.1 Communication parameters and objects

Parameter name	*Conditions*	*Values*
LEDs intensity from bus	-	**no** / yes
	Enables reception from the bus of the brightness value emitted by the LEDs.	
LEDs intensity	LED intensity from bus = no	**100%** [range 0% … 100%]
	Parameter for setting the light intensity value emitted by the LEDs (if not received from the bus).	
LED intensity during Energy Saving	LCD Display ⇒ Energy saving = enabled	**No changes** 0% 10% 20% 30% 40% 50%
	Allows you to set the brightness of the Touch key LEDs in energy-saving mode, independently of the display brightness.	
Technical alarm	-	**disabled** enabled
	Enables communication object no. 0 "Technical alarm", which allows an alarm signal to be triggered via a bus telegram. The flashing LEDs indicate that the alarm is active.	

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Technical alarm	-	1 Bit	C-W--	[1.005] alarm	0
LEDs intensity percentage	LED intensity from bus = yes	1 byte	C-W--	[5.001] percentage	2

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8.8 Temperature control

The ***Temperature Control*** tab contains the following sub-tabs:

- Settings
- Heating
- Cooling
- Ventilation
- Air conditioning

The **Cooling** sub-tab appears only if the *Thermostat Function* parameter in the **Settings** tab is set to *Cooling* or *Both heating and cooling*.

The **Ventilation** sub-tab appears only if the *Control type* in the **Heating** (or **Cooling**) tab is set to *Fancoils*, or if, with *Control type* set to any, the "*Ventilation for Auxiliary Heating (or Cooling)*" parameter is enabled.

The **Air Conditioning** sub-tab appears only if the *Air Conditioning application* parameter in the **Settings** tab is set to a value other than "*disabled*."

8.8.1 Settings

The ***Settings*** tab contains the following parameters:

- Thermostat function
- Command communication object
- Heating – cooling switch over
- Heating – cooling cyclic sending interval
- Setpoint cyclic sending interval
- Max setpoint temperature change
- Air conditioning application
- Valve protection function
- Frequency
- Time interval

8.8.1.1 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Thermostat function		**heating** cooling both heating and cooling
Command communication object	Thermostat function = both heating and cooling Air conditioning application = disabled	unique / **separate**
Heating – cooling switch over	Thermostat function = both heating and cooling Air conditioning application = disabled	manual / **from bus (*)** / automatic
	(*) If Air conditioning application = Underfloor panel + split, the only option available is “via bus”.	

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Parameter name	***Conditions***	***Values***
Heating-cooling cyclic sending interval	Thermostat function = both heating and cooling Air conditioning application = disabled or Underfloor panel + split	**no sending** [other values in the range 30 s … 120 min]
Setpoint cyclic sending interval		**no sending** [other values in the range 30 s … 120 min]
	The setpoint value that can be sent cyclically is the actual setpoint, which depends on the operating mode set manually by the user or automatically by another KNX supervisor device, with the option of time-based programming. The actual setpoint value also takes into account the status of any window contacts and presence detection (provided the corresponding functions have been enabled).	
Max. setpoint temperature change		not permitted, ± 1°C, ± 2°C, ± 3°C, ± 4°C, ± 5°C, ± 6°C, ± 7°C, ± 8°C, **± 9°C**, ± 10°C
	Defines the maximum permitted range for changing temperature setpoint values in the various operating modes.	
Air conditioning application	Thermostat function = both heating and cooling	**Disabled** Underfloor panel + split Only split Simple On/Off
	Selecting a value other than “Disabled” enables the “Air conditioning” sub-tab in the tree structure.	
Send feedback on status change from bus	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	**disabled** / enabled
	If this parameter is enabled, all communication objects relating to the Air conditioning application (Setpoint, Control mode, Fan speed and Manual/Automatic mode) send their values to the bus when changed.	
On status change from UI, discard new status from bus	Thermostat function = both heating and cooling HVAC interface ≠ disabled	**disabled** / enabled
	If this parameter is enabled, when a parameter (setpoint, control mode, fan speed or manual/automatic mode) is changed via the user interface, no further changes via the bus will be accepted for the configured timeout period.	
Timeout	Thermostat function = both heating and cooling Air conditioning application ≠ disabled When the status is changed via the UI, do not accept new statuses from the bus = enabled	**00:00:04.000 hh:mm:ss.fff** [range 00:00:00.000 … 00:10:55.350]
	Timeout for setting further changes to the Air conditioning application parameters via the bus.	
Valve protection function		**disabled** / enabled
	Enables the function that activates the valve control actuators during periods of prolonged system inactivity.	
Frequency	Valve protection function = enabled	once a day, **once a week**, once a month

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Parameter name	***Conditions***	***Values***
Time interval	Valve protection function = enabled	**10 s** [other values in the range 5 s … 20 min]

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. Objects***
Actual setpoint		2 bytes	CR-T-	[9.001] temperature (°C)	52
Heating/cooling status out	Thermostat function = both heating and cooling Air conditioning application = disabled or Underfloor panel + split	1 Bit	CR-T-	[1.100] heating/cooling	48
	The communication object is updated on the bus upon the switching event processed internally by the controller. The object is always exposed and contains information on the current operating mode of the internal temperature controller. **[1.100] DPT Heat/Cool 1 Bit** **0 = Cool** **1 = Heating**				
Heating/cooling status in	Thermostat function = both heating and cooling; Heating/cooling switch over = via bus or Air conditioning application = disabled or Underfloor panel + split	1 Bit	C-W---	[1.100] heating/cooling	49
	The communication object is received via the bus. Upon the switching event, the internal controllers of the primary and auxiliary stages (if enabled) switch the operating mode. The active operating mode is indicated by the corresponding symbol on the display.				
Enable thermostat command		1 Bit	CRWTU	[1.003] Enable	50
	Enables or disables the thermostat function.				
Enabled thermostat status		1 bit	CR-T-	[1.011] State	51
	Returns the thermostat status value (enabled or disabled).				
Temperature setpoint change lock	At least one room temperature sensor enabled	1 Bit	C-W--	[1.003] Enable	98
	Enables or disables the lock on setpoint changes via the UI (changes via the bus are still possible).				

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Note on heating and cooling system terminals

The thermostat's application functions, which can be configured using the ETS application, are particularly suited to the control of the following system terminals via KNX actuators (generic or dedicated):

- radiators;
- electric heaters;
- fan coils;
- radiant panels;
- dehumidifiers;
- radiant panels + radiators (as a backup system);
- radiant panels + fan coils (as a backup system);
- radiant panels + dehumidifiers.

8.8.1.2 Heating/cooling switching

Switching between the two operating modes of the system (heating and cooling) can be carried out as follows:

1. manually on the unit at the user's initiative;
2. automatically by the unit;
3. via the KNX bus using a specific communication object.

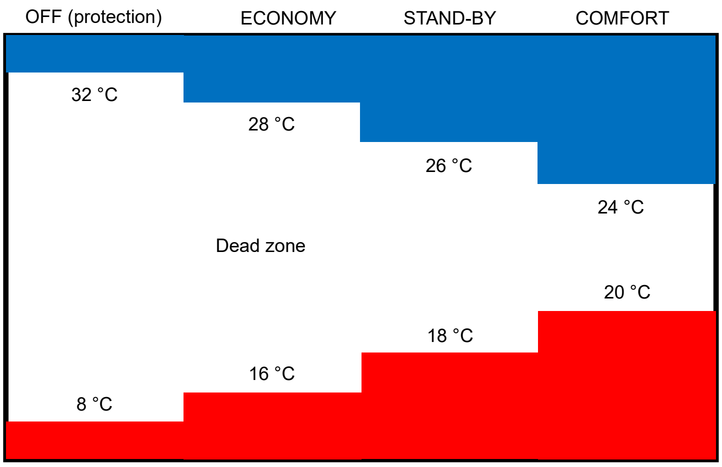
Manual switching (mode 1)

Manual switching is suitable for bus systems with a single room thermostat or a small number of thermostats. If the devices have been configured for this purpose, the user switches the system manually via the display of a thermostat (the device acting as the 'master' for the switching function); the device sends the output communication object [DPT 1.100 heat/cool] to the bus, which may then switch the other thermostats ('slave' devices) connected via a specific group address.

Automatic switching (mode 2)

Automatic switching is suitable for a 4-pipe hydraulic configuration of the heating/air-conditioning system (used, for example, to supply fan-coil units or radiant ceiling panels). In this case too, the information can be sent over the bus using the output communication object [DPT 1.100 heat/cool]; the difference compared to mode 1 is that switching is carried out automatically by the unit based on a comparison between the actual temperature and the setpoint temperature. In this mode, manual switching by the user is disabled.

Automatic switching is achieved by introducing a deadband in accordance with the diagram shown in the figure below.



Deadband and example of consistently distributed setpoint values

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As long as the actual (measured) temperature is below the setpoint value for heating, the operating mode remains heating; similarly, if the actual (measured) temperature is above the setpoint value for cooling, the operating mode is cooling. If the actual (measured) temperature is within the dead zone, the operating mode remains the one previously active; the switching point for the heating/cooling operating mode must occur at the current setpoint of the selected HVAC mode, and similarly, the switch from cooling to heating must occur at the set heating setpoint.

Switchover via the KNX bus (mode 3)

Switching via the bus requires the command to come from another KNX device, such as another thermostat or a Touch&See unit configured for this purpose. This acts as a ‘supervisory’ device: switching takes place via the input communication object [DPT 1.100 heat/cool]. In this mode, manual switching by the user is disabled. Thanks to this mode, the supervising device is able to have the ‘slave’ devices execute timed programmes, thereby extending their function to that of a programmable thermostat (centrally controlled by the supervising device).

The communication objects shown in the block diagram allow the current operating mode set on the temperature controller to be monitored and modified. Object 48 – *Heating/Cooling Status Out* is always displayed, even when the thermostat function is set to heating only or cooling only. If the function is both heating and cooling, cyclic transmission of the object over the bus can be enabled; in all cases, information on the current operating mode can be retrieved by issuing a read request to this communication object.

Object 49 – *Heating/cooling status in* is only exposed when the function is set to both heating and cooling and the switch between modes is controlled via the bus.

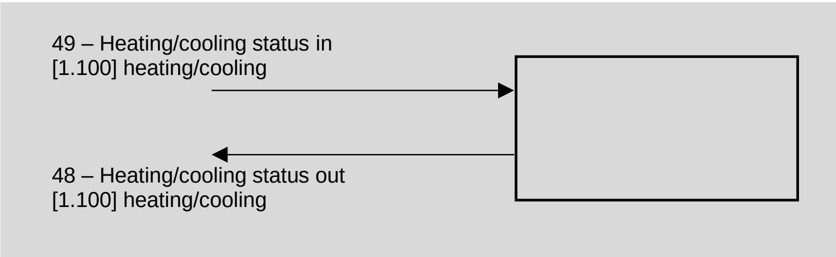

Figure 9 - Heating/Cooling switch over from bus

8.8.1.3 Valve protection function

This function is suitable for heating and cooling systems that use water as the heat transfer fluid and are fitted with motorised valves for shutting off a zone or a single room. Long periods of system inactivity can cause the valves to seize up: to prevent this, the thermostat can periodically send a command to open or close the valves whilst the system is not in use. This option is available in the application programme via the ‘Valve protection function’ parameter, which is further defined by the frequency and duration of valve operation.

8.8.1.4 Remote Setpoint Adjustment

The communication objects shown in the block diagram of**Errore. L'origine riferimento non è stata trovata.** a llow monitoring of forced setpoint changes made locally by the user interacting with the thermostat via the touch buttons. The same communication object (hereinafter ‘O.C.’) also allows changes to be made remotely, for example from a system supervisor.

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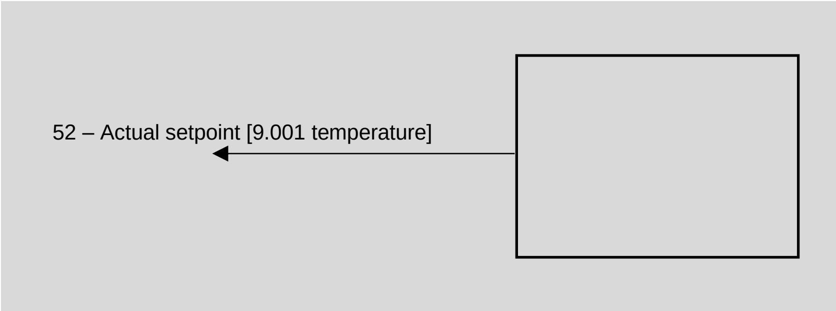

Figure 10 - Setpoint adjustment

The supervisor can directly adjust the setpoint for the heating and cooling operating modes (O.C. with indices 60 and 61). The value of O.C. *52 – Actual setpoint* represents the current operational setpoint on which the control algorithms are based.

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8.8.2 Heating

The ***Heating*** tab contains the following parameters:

- Temperature setpoint [°C]
- Heating type
- Control type
- Hysteresis
- Hysteresis position
- Cyclic sending interval
- Min change of value to send [%]
- PWM cycle time
- Proportional band [0.1 K]
- Integral time [min]
- Floor temperature limitation
- Temperature limit [°C]
- Hysteresis [K]
- Auxiliary heating
- Communication object
- Disabled via the bus
- Deviation from the setpoint
- Hysteresis
- Cyclic sending interval
- Ventilation for auxiliary heating

8.8.2.1 Parameters and communication objects

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

Parameter name	***Conditions***	***Values***
Temperature setpoint [°C]		**21** [range 2 … 50]
Heating type		**radiators** electric fancoils floor radiant panels ceiling radiant panels
	Defines the terminal used for heat exchange in the room. The choice determines the parameters of the PWM control algorithm (proportional band and integral time) and the control options.	
Control type		**2-point hysteresis**, PWM (pulse width modulation) continuous
Hysteresis	Control type = 2-point hysteresis	**0.3 K** [other values in the range 0.2 K … 3 K]

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Parameter name	*Conditions*	*Values*
Hysteresis position	Heating type = radiant panels (ceiling or floor) Control type = 2-point hysteresis	**below** above
Cyclic sending interval	Control type = 2-point hysteresis, continuous	**no sending** [other values in the range 30 s … 120 min]
Min change of value to send [%]	Control type = continuous	**10** [range 0 … 100]
PWM cycle time	Control type = PWM (pulse width modulation)	**15 min** [range 5 … 240 min]
Proportional band [0.1 K]	Control type = continuous or PWM	**(*)** [range 0 … 255]
	The value is expressed in tenths of a degree Kelvin (K). **) The field contains a preset value that depends on the selected heating type (the value can be changed):* • *radiators: 50 (5 K)* • *electric: 40 (4 K)* • *fan coils: 40 (4 K)* • *floor radiant panels: 50 (5 K)* • *ceiling radiant panels: 50 (5 K)* *The value of the Proportional Band parameter represents the maximum deviation between the setpoint temperature and the measured temperature that triggers the maximum control output.*	
Integral time [min]	Control type = continuous or PWM	**(*)** [other values in the range 0 … 255 min]
	**) The field contains a preset value that depends on the selected heating type (the value can be changed):* • *radiators: 150 min* • *electric: 100 min* • *fan coils: 90 min* • *floor radiant panels: 240 min* • *ceiling radiant panels: 180 min*	

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Parameter name	***Conditions***	***Values***
Min. control value [%]	Control type = continuous or PWM	**15** [range 0 … 30]
	Allows the PWM cycle to be adapted for use with electrothermal actuators with very long opening times. For control variable values lower than the set value, the minimum value is used.	
Max. control value [%]	Control type = continuous or PWM	**85** [range 70 … 100]
	Allows the PWM cycle to be adapted for use with electrothermal actuators with very long opening times. For control variable values higher than the set value, the maximum value is used.	
Floor temperature limitation	Heating type = floor radiant panels, Inputs⇒ Input 1⇒ Application = floor surface temperature sensor, Inputs⇒ Input 2⇒ Application = floor surface temperature sensor, External sensors⇒ floor surface temperature sensor = enabled	**disabled** / enabled
	This parameter enables the function to limit the surface temperature of an underfloor heating system. For this function to work, it is essential to measure the surface temperature of the floor by enabling the corresponding temperature sensor in the External Sensors tab (from the bus) or in the Inputs tab. ***Important.*** *This function is not a substitute for the over-temperature protection normally provided in hydronic underfloor heating systems, which is implemented by means of the appropriate safety thermostat.*	
Temperature limit [°C]	Floor temperature limit = enabled	**29** [range 20 … 40]
	According to standard EN 1264, a maximum permissible temperature for the surface of the underfloor heating system is specified: • *T(sup) max ≤ 29°C for normally occupied areas;* • *T(sup) max ≤ 35°C for peripheral areas of rooms.* *National regulations may also limit these temperatures to lower values. Peripheral areas are defined as zones generally situated along the walls of the room facing the exterior of the building, with a maximum width of 1 m.*	
Hysteresis [K]	Floor temperature limit = enabled	**0.3 K** [other values in the range 0.2 K … 3 K]
	The surface temperature is expected to fall below the set threshold by an offset equal to the hysteresis value before the alarm state is cleared.	
Auxiliary heating		**disabled** / enabled
Communication object	Auxiliary heating = enabled	single **separate**
Disabled from bus	Auxiliary heating = enabled	**no** / yes
	Enables the function to be activated and deactivated via a telegram from a supervisory device on the bus.	
Offset from setpoint	Auxiliary heating = enabled	**0.6 K** [other values in the range 0 … 3 K]
Hysteresis	Auxiliary heating = enabled	**0.3 K** [other values in the range 0.2 K … 3 K]
Cyclic sending interval	Auxiliary heating = enabled	**no sending** [other values in the range 30 s … 120 min]

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Parameter name	*Conditions*	*Values*
Ventilation for auxiliary heating	Heating type = floor radiant panels or ceiling radiant panels	**disabled** / enabled
	This option allows you to combine a high-inertia system such as underfloor heating (in the water-fed version) with a low-inertia system such as a fan coil unit.	

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Setpoint (heating)		2 bytes	CRWTU	[9.001] temperature (°C)	60
Heating out command	Control type = 2-point hysteresis or PWM Command communication object = separated	1 bit	CR-T-	[1.001] switch	68
Heating and cooling out command	Control type = 2-point hysteresis or PWM Command communication object = unique	1 bit	CR-T-	[1.001] switch	68
Heating out command	Control type = continuous Command communication object = separated	1 Byte	CR-T-	[5.001] percentage (0..100%)	68
Heating and cooling out command	Control type = continuous Command communication object = unique	1 Byte	CR-T-	[5.001] percentage (0..100%)	68
Auxiliary heating ouput command	Auxiliary heating = enabled	1 bit	CR-T-	[1.001] switch	70
Disable auxiliary heating	Auxiliary heating = enabled, Disabled from bus = yes	1 bit	C-W---	[1.003] enable	72

Note on the floor temperature limitation function (also known as ‘surface’ limitation)

A water-based underfloor heating system comprises plastic pipes embedded in the concrete screed or laid directly beneath the final floor covering (lightweight or ‘dry’ system), through which heated water flows. The water transfers heat to the final floor covering, which heats the room by radiation. The standard EN 1264 Underfloor Heating (Part 3: Systems and components – Design) specifies a maximum permissible temperature (T_{Smax}) for the floor surface, corrected from a physiological point of view, defined as follows:

- T_{Smax} ≤ 29°C for areas of normal occupancy;

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- T_{Smax} ≤ 35°C for peripheral areas of rooms.

National regulations may also limit these temperatures to lower values. Peripheral areas are defined as zones generally situated along the walls of the room facing the exterior of the building, with a maximum width of 1 m.

An electrically powered underfloor heating system involves laying an electric cable beneath the floor covering, powered by mains voltage (230 V) or extra-low voltage (e.g. 12 or 45 V), which may already be supplied in rolls with a constant spacing between cable sections. The live cable transfers heat to the floor covering above, which heats the room by radiation. Temperature control is based on measurements of the room air temperature, but generally involves monitoring and limiting the surface temperature using an NTC-type sensor in contact with the floor surface.

Limiting the surface temperature may be necessary for several reasons:

- physiological compatibility (correct temperature at the level of the lower limbs);
- use of the system as an auxiliary heating stage. In this case, heat loss to the outside of the building is managed by the main heating system, whilst the auxiliary stage operates solely to maintain the floor temperature at a comfortable level (for example, in bathrooms of residential buildings, sports centres, thermal centres and spas, etc.);
- protection against damage to the final floor covering caused by accidental overheating. It should be noted that water-based systems are usually already fitted with a safety thermostat (which acts on the hydraulic mixing unit), whilst in the case of electrically powered systems this device cannot be used, and it is common practice to implement a specific temperature limit using a surface temperature sensor connected to the unit.

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8.8.3 Cooling

The ***Cooling*** tab contains the following parameters:

- Temperature setpoint [°C]
- Cooling type
- Control type
- Hysteresis [K]
- Hysteresis position
- Cyclic sending interval
- Min. change of value to send [%]
- PWM cycle time
- Proportional band [0.1 K]
- Integral time [min]
- Anticondensation protection with probe
- Active anticondensation
- Flow temperature (project)
- Anticondensation hysteresis range
- Delay for alarm signal
- Auxiliary cooling
- Disabled from bus
- Offset from setpoint
- Hysteresis [K]
- Cyclic sending interval
- Ventilation for auxiliary cooling

8.8.3.1 Parameters and communication objects

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

Parameter name	***Conditions***	***Values***
Temperature setpoint [°C]		**23** [range 10 … 50]
Cooling type	-	fancoil, underfloor radiant panels, ceiling radiant panels
	If, in Settings, the parameter ‘Thermostat function’ is set to ‘heating and cooling’ and ‘Communication command object’ is set to ‘single’, the ‘Cooling type’ is determined by the selection made under ‘Heating’.	
Control type	Settings -> Command communication object = separated	**2-point hysteresis**, PWM (pulse width modulation), continuous
	If, in Settings, the Thermostat function parameter is set to ‘Heating and cooling’ and the Command communication object is set to ‘Single’, the Cooling type is determined by the selection made under Heating.	
Hysteresis	Control type = 2-point hysteresis	**0.3 K** [other values in the range 0.2 K … 3 K]

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Parameter name	*Conditions*	*Values*
Hysteresis position	Cooling type = radiant panels (ceiling or floor) Control type = 2-point hysteresis	below **above**
Cyclic sending interval	Control type = 2-point hysteresis, continuous	**no sending** [other values in the range 30 s … 120 min]
Min. change of value to send [%]	Control type = continuous	**10** [range 0 … 100]
PWM cycle time	Control type = PWM (pulse width modulation)	**15 min** [range 5 … 240 min]
Proportional band [0.1 K]	Control type = continuous or PWM	* [range 0 … 255]
	The value is expressed in tenths of a degree Kelvin (K). **) The field contains a preset value that depends on the selected heating type (the value can be changed):* • *fan coil: 40 (4 K)* • *underfloor heating: 50 (5 K)* • *radiant ceiling: 50 (5 K)* *The value of the Proportional Band parameter represents the maximum deviation between the setpoint temperature and the measured temperature that triggers the maximum control output.*	
Integral time [min]	Control type = continuous or PWM	* [field 0 … 255 min]
	**) The field contains a preset value that depends on the selected heating type (the value can be changed):* ▪ *fan coil: 90 min* ▪ *underfloor heating: 240 min* ▪ *radiant ceiling: 180 min*	
Min. control value [%]	Control type = continuous or PWM	**15** [range 0 … 30]
	Allows the PWM cycle to be adapted for use with electrothermal actuators with very long opening times. For control variable values lower than the set value, the minimum value is used.	
Max. control value [%]	Control type = continuous or PWM	**85** [range 70 … 100]
	Allows the PWM cycle to be adapted for use with electrothermal actuators with very long opening times. For control variable values higher than the set value, the maximum value is used.	
Anticondensation with probe	Cooling type = floor or ceiling radiant panels Inputs ⇒ Input 1⇒ Use = anticondensation sensor, Inputs ⇒ Input 2 ⇒ Use = anticondensation sensor	**disabled** / enabled

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Parameter name	***Conditions***	***Values***
Active anticondensation	Cooling type = floor or ceiling radiant panels External sensors⇒ Flow temperature = disabled	**disabled** enabled (project temperature)
	Cooling type = floor or ceiling radiant panels External sensors⇒ Flow temperature = enabled	**disabled** enabled (comparison between flow temperature and dew point temperature)
	If the flow temperature is lower than the calculated dew point temperature, the system is in cooling mode and the room thermostat is requesting flow, the thermostat closes the valve and displays an alarm message on the screen.	
Flow temperature (project)	Cooling type = floor or ceiling radiant panels External sensors⇒ Radiant system flow temperature = disabled Active anticondensation = enabled	**14°C** [other values in the range 14.5°C … 20°C]
	Appears only if the flow temperature from an external sensor (via the bus) is not available.	
Anti-condensation hysteresis range [K]	Active anticondensation = enabled (comparison between flow temperature and dew point temperature)	0.2 K / 0.3 K / 0.4 K / **0.5** / 0.6 K 0.8 K / 1 K / 1.5 K / 2 K / 2.5 K / 3 K
	Before exiting the alarm condition, the system waits until the calculated dew point temperature is greater than the flow temperature by an offset equal to the hysteresis value.	
Delay for alarm signal	Active anticondensation = enabled or Anticondensation with probe = enabled	**5 minutes** [other values in the range 30s … 120 minutes]
	Delay between the occurrence of the condition 'Calculated dew point temperature > Supply air temperature' and the transmission of the alarm signal.	
Auxiliary cooling	-	**disabled** / enabled
Disabled from bus	Auxiliary cooling = enabled	**no** / yes
	This parameter enables the function to be activated and deactivated via a telegram from a bus device with supervisory function.	
Offset from setpoint	Auxiliary cooling = enabled	0.2 K / 0.3 K / 0.4 K / 0.5 / **0.6 K** 0.8 K / 1 K / 1.5 K / 2 K / 2.5 K / 3 K
Hysteresis [K]	Auxiliary cooling = enabled	0.2 K / **0.3 K** / 0.4 K / 0.5 / 0.6 K 0.8 K / 1 K / 1.5 K / 2 K / 2.5 K / 3 K
Cyclic sending interval	Auxiliary cooling = enabled	**no sending** [other values in the range 30 s … 120 min
	"No sending" means that cyclic transmission is not enabled.	
Ventilation for auxiliary cooling	Cooling type = floor or ceiling radiant panels	**disabled** / enabled
	This option allows you to combine a high-inertia system such as underfloor heating (in the water-fed version) with a low-inertia system such as a fan coil.	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. Objects***
Setpoint (cooling)		2 bytes	CRWTU	[9.001] temperature (°C)	61

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. Objects*
Cooling out command	Control type = 2-point hysteresis or PWM	1 bit	CR-T-	[1.001] switch	69
Cooling out command	Control type = continuous	1 byte	CR-T-	[5.001] percentage (0..100%)	69
Auxiliary cooling output command	Auxiliary cooling = enabled	1 bit	CR-T-	[1.001] switch	71
Disable auxiliary cooling	Auxiliary cooling = enabled, Disabled from bus = yes	1 bit	C-W---	[1.003] enable	73
Anticondensation alarm	At least one anticondensation protection enabled	1 bit	CR-T-	[1.005] alarm	100

Note on the anti-condensation protection function

The purpose of this function is to prevent condensation from forming on the heat exchange surfaces of the system or building during cooling operation. The function is used primarily in systems with surface heat exchange, such as underfloor and ceiling radiant panels during summer operation. In this case, chilled water flows through the hydraulic circuits; normally, latent loads (caused by an increase in the room humidity level) are handled by dedicated air-handling units, and the thermo-hygrometric conditions are far removed from those that cause condensation to form. If this is not achieved satisfactorily, or in the event of the air-handling units being shut down, additional safeguards must be put in place to prevent or limit the accidental formation of condensation on cold surfaces.

Generally speaking, anti-condensation protection can be achieved by:

- by installing a dedicated anti-condensation sensor in the room; when this is triggered, the hydraulic circuit serving the room in question is shut off. This is a *passive form of* protection, meaning that the intervention occurs once condensation has already begun to form;
- by calculating the dew point temperature and comparing it with the flow temperature of the heat transfer fluid. If the comparison indicates that conditions critical for condensation formation are approaching, action is taken by shutting off the hydraulic circuit or readjusting the mixing conditions of the heat transfer fluid. This is an *active form of* protection, meaning that the intervention is intended to prevent the conditions for condensation formation.

No.	Type	Designation	Description
1a	Passive	Anti-condensation protection with sensor (connected to the thermostat's physical input)	Hardware-based protection that intervenes by closing the cooling circuit serving the room or zone when condensation is detected by an anticondensation sensor connected to a thermostat input. The communication object used is 69: Cooling out command [DPT 1.001 switch].
1b	Passive	Anti-condensation protection with sensor (via bus)	As in 1a, but the thermostat receives information about condensation via the bus from another KNX device using communication object 46: Anticondensation (from bus) [DPT 1.001 switch].
2a	Active	Anti-condensation protection with comparison between T_{flow} (fixed design value, set as a parameter in ETS) and	Software-based protection that intervenes by closing the cooling circuit serving the room or zone when the flow temperature defined in the hydronic system design (set in the corresponding ETS parameter) is lower than the dew point temperature calculated by the room thermostat using the temperature and

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		$T_{dew\ point}$ (calculated by the thermostat)	relative humidity values of the room air. The communication object used is 69: Cooling out command [DPT 1.001 switch].
2b	Enable	Anti-condensation protection with comparison between T_{flow} (measured value sent over the bus) and $T_{dew\ point}$ (calculated by the thermostat)	Software-based protection that intervenes by shutting off the cooling circuit serving the room or zone when the flow temperature – as actually measured and received via the bus from another KNX device – is lower than the dew point calculated by the room thermostat using the temperature and relative humidity values of the room air. The communication objects used are input object 42: Flow temperature (from bus) [DPT 9.001 temperature °C] and object 69: Cooling out command [DPT 1.001 switch].
3	Enable	Anti-condensation protection with transmission of the dew point temperature to the bus and recalibration of the supply air temperature	A software-based protection system that sends the dew point temperature – calculated by the room thermostat using the temperature and relative humidity values of the ambient air – via the bus to a KNX device capable of controlling the mixing of the heat transfer fluid to be sent to the cooling circuits. The KNX device that receives the dew point temperature sent by the thermostat is responsible for adjusting the control valve. The communication object used is 90: Dew point temperature [DPT 9.001 temperature °C].

Figure 11 - Possible anti-condensation protection methods

If an anti-condensation sensor is used, a device fitted with a signal contact (potential-free) must be provided. The following options are available:

- connecting the signalling contact to an input on the room thermostat configured as digital (Inputs⇒ Input 1 or 2 = [DI] anticondensation sensor). The signal from the sensor is processed directly by the thermostat (case 1a in the table);
- connecting the signalling contact to an input channel of another KNX device, for example a push-button interface or a binary input (External Sensors (from the bus)⇒ Anticondensation = enabled). In this case, the signal from the probe is communicated to the thermostat via the bus through the status of a communication object (case 1b in the table).

If the comparison between the dew point temperature calculated by the thermostat and the flow temperature of the heat transfer fluid is used, there are three possibilities:

- if the flow temperature measurement is not available (case 2a in the table), the value used in the system design can be entered in the Flow Temperature (project) parameter for the comparison;
- if the flow temperature measurement is available (case 2b in the table), set the 'Active anticondensation active' parameter to the enabled value for the comparison;
- if there is an actuator on the bus capable of adjusting the heat transfer fluid mix, the thermostat sends the calculated dew point temperature value to the bus; the actuator compares this value with the flow temperature and, if necessary, adjusts the mixing conditions to prevent the thermo-hygrometric conditions that could lead to condensation.

The anti-condensation protection mode to be adopted must be assessed during the design phase of the heating system and depends on factors such as the type of building, service continuity and the level of comfort to be provided, the available KNX devices, etc.

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8.8.4 Ventilation (main and auxiliary)

The ***Ventilation*** tab contains the following parameters:

- 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. chage of value to send [%]
- Manual operation
- Hot start
- Min. temperature to start ventilation [°C]
- Antistratification function
- Antistratification temperature differential
- Hysteresis
- Disable ventilation via the bus
- Signal (disable) from the bus
- Fan start delay
- Fan stop delay
- Cyclic sending interval

The conditions for the Ventilation tab to appear are:

- *Heating*⇒ Heating type = fancoil or
- *Cooling*⇒ Cooling type = fancoil or a combination of the two conditions:
- *Heating*⇒ Heating type = any *and Heating*⇒ *Auxiliary heating*⇒ Ventilation for auxiliary heating = enabled
- *Cooling*⇒ Cooling type = any *and Cooling*⇒ *Auxiliary cooling*⇒ Ventilation for auxiliary cooling = enabled

This allows you to control two types of system: i) fancoil units or ii) radiant panel units (either floor or ceiling), electric or radiators as the primary stage and fan-coil units as the secondary stage.

8.8.4.1 Ventilation tab with active air-conditioning interface

A further condition for the Ventilation tab to appear is as follows:

- *⇒ settings: Thermostat function = both heating and cooling* and Air conditioning application ≠ disabled.

In this case, the ***Ventilation*** tab contains the following parameters:

- Control type
- Data point type
- Fan speed 1 value
- Fan speed 2 value
- Fan speed 3 value
- Fan AUTO with value
- Fan speed AUTO value
- The user can turn speed 1
- The user can turn speed 2
- The user can turn speed 3
- Hot start

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- Min. temperature to start ventilation [°C]
- Antistratification function
- Antistratification temperature differential
- Hysteresis
- Disable ventilation via bus
- Signal (disable) from bus
- Fan start delay
- Fan stop delay
- Cyclic sending interval

8.8.4.2 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Control type	Thermostat function = both heating and cooling and Air conditioning application = disabled	**1 speed** 2 speeds 3 speeds Continuous regulation
Control type	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	**3 speeds** Continuous regulation
Data point type	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	**DPT 5.100** DPT 5.001
Threshold first speed [0.1 K]	Thermostat function = both heating and cooling and Air conditioning application = disabled Control type >= 1 speed	**10** [range 0 … 255]
	The value is expressed in tenths of a °C. If the Thermostat function parameter is set to 'Heating and cooling', the threshold value applies to both operating modes.	
Threshold second speed [0.1 K]	Thermostat function = both heating and cooling and Air conditioning application = disabled Control type >= 2 speed	**20** [range 0 … 255]
	The value is expressed in tenths of a °C. If the Thermostat function parameter is set to 'Heating and cooling', the threshold value applies to both operating modes. For the fan coil to operate correctly, the following constraint must be met: Second speed threshold > First speed threshold.	

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Parameter name	*Conditions*	*Values*
Threshold third speed [0.1 K]	Thermostat function = both heating and cooling and Air-conditioning application = disabled Control type = 3 speed	**30** [range 0 … 255]
	The value is expressed in tenths of a °C. If the Thermostat function parameter is set to 'Heating and cooling', the threshold value applies to both operating modes. For the fan coil to operate correctly, the following condition must be met: Third speed threshold > Second speed threshold.	
Speed control hysteresis [K]	Thermostat function = both heating and cooling and Air-conditioning application = disabled Control type = 1, 2 or 3 speeds	**0.3 K** [other values in the range 0.2 K … 3 K]
Speed proportional band [0.1 K]	Thermostat function = both heating and cooling and Air conditioning application = disabled Control type = continuous regulation	**30** [range 0 … 255]
	The value is expressed in tenths of a °C. If the Thermostat function parameter is set to 'Heating and cooling', the threshold value applies to both operating modes.	
Min. change of value to send [%]	Thermostat function = both heating and cooling and Air conditioning application = disabled Control type = continuous control	**10** [range 2 … 40]
	See also the chapter on Control Algorithms for further information on the meaning of this parameter.	
Manual operation		**Not depending on the temperature** Depending on the the temperature
	If the Manual operation parameter is set to 'temperature-independent', the fan remains at the speed set by the user even when the temperature setpoint is reached; if, on the other hand, Manual operation is set to 'temperature-dependent', the fan stops when the temperature setpoint is reached.	

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Parameter name	***Conditions***	***Values***
Fan speed 1 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5.100	**1** [range 0 … 255]
	Value corresponding to fan speed 1, with DPT value 5.100.	
Fan speed 2 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5,100	**2** [range 0 … 255]
	Value corresponding to fan speed 2, with DPT value 5.100.	
Fan speed 3 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5,100	**3** [range 0 … 255]
	Value corresponding to fan speed 3, with a DPT numerical value of 5,100.	
Fan speed 1 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 3-speed DPT = 5,001	**33%** [range 0 … 100%]
	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.001	**20%** [range 0 … 100%]
	Value corresponding to fan speed 1, with DPT percentage value 5.001.	
Fan speed 2 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 3-speed DPT = 5.001	**67%** [range 0 … 100%]
	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.001	**40%** [range 0 … 100%]
	Value corresponding to fan speed 2, with DPT percentage value 5.001.	
Fan speed 3 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 3-speed DPT = 5.001	**100%** [range 0 … 100%]

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Parameter name	***Conditions***	***Values***
	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.001	**60%** [range 0 … 100%]
	Value corresponding to fan speed 3, with DPT percentage value 5.001.	
Fan speed 4 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.100	**4** [range 0 … 255]
	Value corresponding to fan speed 4, with continuous control and a DPT value of 5.100.	
Fan speed 5 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.100	**5** [range 0 … 255]
	Value corresponding to fan speed 5, with continuous control and a DPT value of 5.100.	
Fan speed 4 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5.001	**80%** [range 0 … 100%]
	Value corresponding to fan speed 4, with a DPT percentage value of 5.001.	
Fan speed 5 value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5.001	**100%** [range 0 … 100%]
	Value corresponding to fan speed 5, with a DPT percentage value of 5.001.	
Fan AUTO with value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	**disabled** enabled
AUTO fan speed value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 3-speed DPT = 5,100	**4** [range 0 … 255]

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Parameter name	*Conditions*	*Values*
	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation DPT = 5.100	**6** [range 0 … 255]
	Value corresponding to the AUTO fan speed, with continuous control and a DPT value of 5.100.	
Fan speed AUTO value	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled DPT = 5.001	**0%** (cannot be changed)
	Value corresponding to the AUTO fan speed, with DPT 5.001.	
The user can turn speed 1	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	No **Yes**
	Enables the user to activate speed 1 via the display interface.	
The user can turn speed 2	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	No **Yes**
	Enables the user to activate speed 2 via the display interface.	
The user can turn speed 3	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled	No **Yes**
	Enables the user to activate speed 3 via the display interface.	
The user can turn speed 4	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation	No **Yes**
	Enables the user to activate speed 4 via the display interface.	
The user can turn speed 5	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = Continuous regulation	No **Yes**
	Enables the user to activate speed 5 via the display interface.	
Hot start	Thermostat function = heating orboth heating and cooling, Inputs⇒ Input X⇒ [AI] coil battery temperature sensor or External sensors (from bus)⇒ coil temperature = enabled	**no** / yes
	For this function to operate, at least one sensor must be enabled to measure the water temperature at the fan coil's heat exchanger. This can be either an input configured as analogue or an external sensor (from the bus).	
Min. temperature to start ventilation [°C]	Hot start = yes	**28** [range 28 … 40]
	If enabled, the function is active only during heating mode.	

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Parameter name	***Conditions***	***Values***
Antistratification function	Inputs ⇒ Input X ⇒ [AI] antistratification temperature sensor or External sensors (from the bus)⇒ antistratification temperature = enabled	**disabled** / enabled
	For this function to operate, at least one sensor must be enabled to measure a second room temperature value at a different height from that of the thermostat. This can be either an input configured as analogue or an external sensor (from the bus).	
Antistratification temperature differential	Antistratification function = enabled	**2.00 [K/m]** [other values in the range 0.25 … 4.00]
	The DIN 1946 standard recommends not exceeding a value of 2 K/m for rooms of standard height (between 2.70 and 3 m).	
Hysteresis	Anti-stratification function = enabled	**0.5 K** [other values in the range 0.2 … 3 K]
	Set a hysteresis value for the anti-stratification temperature.	
Disables ventilation from bus	-	**no** / yes
Signal from bus	Disable ventilation via the bus = yes	**not inverted** inverted
Fan start delay	-	**0 s** [other values in the range 10 s … 12 min]
	This also appears when using the hot start mode, which measures the water temperature at the fan coil's heat exchanger coil. The function is active in both operating modes. ***NOTE: The delay only works with a standard hydronic system and in automatic mode.***	
Fan stop delay	-	**0 s** [other values in the range 10 s … 12 min]
	This function allows the fan to continue running, dissipating any residual heat or cold from the heat exchanger coil into the room. The function is active in both operating modes. ***NOTE: The delay only works with a standard hydronic system and in automatic mode.***	
Cyclic sending interval		**No sending** [other values in the range 30 s … 120 min]
	Set a Cyclic sending interval for the ventilation status.	

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Fan speed 1	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 1, 2 or 3 speeds	1 bit	CR-T-	[1.001] switch	80
	Fan speed 1 status (On/Off).				
Fan speed 2	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 2 or 3 speeds	1 bit	CR-T-	[1.001] switch	81
	Fan speed 2 status (On/Off).				
Fan speed 3	Thermostat function = both heating and cooling and Air conditioning application ≠ disabled Control type = 3-speed	1 Bit	CR-T-	[1.001] switch	82
	Fan speed 3 status (On/Off).				
Fan control disable	Disable ventilation from bus = yes	1 Bit	C-W---	[1.002] boolean	83
	Disables the ability to control the fan.				
Fan speed in	Control type = continuous regulation	1 Byte	C-W--	[5.100] fan stage (0…255)	84
	Sends the selected fan speed value.				
Fan speed out	Control type = continuous regulation	1 Byte	CR-T-	[5.100] fan stage (0…255)	85
	Current fan speed status.				
Fan speed man/auto in	Control type = continuous regulation	1-bit	C-W--	[1.002] boolean	86
	Selects MAN (False) or AUTO (True) mode for fan speed.				
Fan speed man/auto out	Control type = continuous regulation	1 Bit	CR-T-	[1.002] boolean	87
	Fan speed status: False = MAN or True = AUTO.				
Fan manual speed off status		1 Bit	CR-T-	[1.11] DPT Status	111
	Manual fan speed status: if it is switched off (Off), then it is Active. If it is switched on at any speed, it takes the value Inactive.				

8.8.4.3 Fan delayed start function ("hot-start")

This function is used when the fan forces air through a heat exchange coil into the room (as in the case of fan-coil units). In heating mode, to avoid any discomfort caused by cold air being blown into the room, the

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thermostat does not start the fan until the fluid has reached a sufficiently high temperature. This situation normally occurs on first start-up or after long periods of inactivity. The function can be controlled by:

1) temperature control (via a temperature sensor on the heat exchanger coil);
2) delayed start (approximate function);

In the first case, the temperature of the heat transfer fluid at the heat exchanger coil is measured. The function therefore provides effective temperature control, but for it to operate, the following conditions must be met:

- the heat exchanger is fitted with a minimum water temperature sensor that measures the temperature of the heat transfer fluid;
- the sensor must be connected to an input on the thermostat (configured as analogue) or to another KNX device equipped with an analogue input.

In the second case, a start-up delay is simply set from the moment the flow request is made; there is no temperature control. The effectiveness of this function depends on a field measurement of the time interval actually required to ensure sufficiently warm air is available at the terminal outlet.

8.8.4.4 Anti-stratification function

This function is used in systems employing convective heat transfer designed to heat spaces with heights and volumes far greater than usual (lobbies, sports halls, commercial premises, etc.). Due to natural convective movements – whereby heated air rises to the upper parts of the room – the phenomenon of air stratification occurs, leading to energy wastage and discomfort for occupants. This function counteracts stratification by forcing the warm air downwards.

Requirements for implementing the anti-stratification function are:

- a high ceiling;
- availability of ventilation units capable of forcing air to move from top to bottom (in the opposite direction to the natural convective movement of heated air);
- temperature measurement at two levels, with a second temperature sensor installed at a height suitable for measuring the actual stratification of the room air mass (the main thermostat is assumed to be installed 1.50 m above the floor).

For rooms of standard height (2.70–3.00 m), the DIN 1946 standard recommends not exceeding 2 K/m to ensure adequate comfort; this gradient may be higher in rooms with greater ceiling heights.

8.8.4.5 2-stage configuration with fan-coil auxiliary stage

Fan-coil units can be used as either a primary or a secondary stage. When used as a primary stage, they can only be combined with radiators on the secondary stage. If, on the other hand, the primary stage consists of a radiant panel system (underfloor or ceiling-mounted), the fan coils can be used as the secondary stage. In the latter case, they operate in automatic mode with a configurable offset relative to the temperature setpoint set for the primary stage and thus perform their compensating function whilst the primary stage reaches the desired temperature with greater thermal inertia.

The *Ventilation* tab, which is a single tab, therefore configures either a primary or secondary stage depending on the settings adopted in the *Heating* and *Cooling* tabs. Similarly, the display interface will control the manual/automatic mode and manual override of the single fan coil unit set.

A special case arises when the fan coil unit acts as a secondary stage in one season and as a primary stage in the other. This is the case, for example,

- a radiant system that operates in heating-only mode and has a fan coil unit as an auxiliary stage; the same fan coil unit functions as the primary stage in cooling mode;

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- a radiator system that has a fan coil as an auxiliary stage in heating mode; the same fan coil operates as the primary stage in cooling mode.

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

1) Settings ⇒ Thermostat function = both heating and cooling. This configuration activates both the Heating and Cooling tabs
2) Heating ⇒ Heating type = floor or ceiling radiant panels
3) Command communication object = separated (if you choose “unique”, the choice of the Cooling ⇒ Cooling type parameter is predetermined).
4) Heating⇒ Auxiliary heating = enabled
5) Auxiliary heating⇒ Communication object = separate
6) Heating⇒ Ventilation for auxiliary heating = enabled
7) ⇒ Cooling Type = fan coil

Important! If the fan-coil system has a 2-pipe hydraulic configuration, the ‘Auxiliary heating output command’ (1 bit) and ‘Cooling out command’ objects must be set to a logical OR at the fan-coil control actuator, which in this case is a single unit.

An alternative solution that avoids the need for a logical OR connection can be achieved by configuring a primary stage for heating and cooling using radiant panels with separate valves, and a secondary stage for heating and cooling using fan coils with combined valves. The offset for the secondary stage in cooling mode is set to 0 (zero); this corresponds to a configuration for the primary stage. The Cooling out command object is not connected, so that the radiant panel system effectively operates in heating mode only.

8.8.4.6 Remote fan speed adjustment

The communication objects shown in the block diagram of Figure 12 allow the actual fan speed to be monitored; this is set automatically (A) by the temperature controller or manually on-site by the user via the touch buttons. The communication objects (hereinafter ‘O.C.’) also allow the same adjustments to be made remotely, for example via a system supervisor.

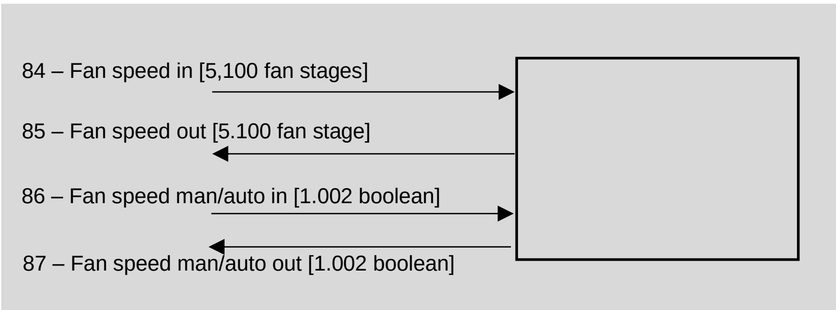

Figure 12 - Remote fan speed adjustment

Communication Object (CO) *85 – Fan speed out* provides the current fan speed; CO 87 – *Fan speed man/auto out* indicates whether the fan is operating in automatic mode (= True, AUTO active) or manual mode (= False, MAN active). By modifying CO 85 – *Fan speed out*, the fan automatically switches to manual control at the set speed; to return to automatic control (symbol A), the supervisor must deactivate manual mode by modifying CO 86 (= True, AUTO active).

The possible values for O.C.s with indices 84 and 85 depend on the number of speeds set via ETS for the fan.

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If the *Control Type* parameter on the *Ventilation* tab is set to 1, 2 or 3 speeds, the following values are accepted for O.C.s with DPT [5.100 fan stage]:

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

If the *Control Type* parameter on the *Ventilation* tab is set to continuous control, the values adopted by the O.C.s with DPT [5.100 fan stage] correspond instead to the following percentages of the maximum speed:

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

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8.8.5 Air conditioning

This tab allows you to configure the data type for the control mode and the corresponding values for the various air conditioning functions.

Depending on the AC application selected, the various options available are set out in the table below:

AC application	Available control modes
Underfloor panel + split	• Off • Heating or cooling, depending on the operating mode set from bus • Fan • Dry
Split only	• Off • Auto • Heating • Cooling • Fan • Dry
Simple On/Off	• Off • Mode set by CO 78 - *CA HVAC control mode in*

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

Air conditioning application = Underfloor panel + split, Split only or Simple On/Off

8.8.5.1 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Type of control mode datapoint	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	**DPT 20.105** Customized
	Allows you to set the control mode datapoint type as DPT 20.105 (HVAC control mode) or with any numeric values in the range 0...255.	
Automatic mode value	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	**0** [field 0 … 255]
	Value identifying AUTO mode.	
Heating mode value	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	**1** [field 0 … 255]
	Value identifying HEAT mode.	
Cooling mode value	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	**3** [field 0 … 255]
	Value identifying COOL mode.	

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Parameter name	***Conditions***	***Values***
Only ventilation mode value	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	**9** [range 0 … 255]
	Value identifying FAN mode.	
Dehumidify mode value	Thermostat function = both heating and cooling Climate control interface ≠ disabled Type of control mode datapoint = Customized	**14** [field 0 … 255]
	Value identifying DRY mode.	
Power Off mode value	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	**6** [range 0 … 255]
	Value identifying the OFF mode.	

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
AC enable in	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	1 Bit	C-W--	[1.001] Switch	74
	Enables or disables the ability to control the air conditioning via the display interface.				
AC enable out	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	1 Bit	CR-T-	[1.001] Switch	75
	Returns the status of the AC control via the display interface.				
AC setpoint in	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	2 bytes	C-W--	[9.001] temperature °C	76
	Send a new setpoint value for the AC.				
AC setpoint out	Thermostat function = both heating and cooling Air conditioning application ≠ disabled	2 bytes	CR-T-	[9.001] temperature °C	77
	Returns the setpoint value for AC.				
AC HVAC control mode in	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = DPT 20.105	1 Byte	C-WTU	[20.105] HVAC control mode	78
	Sets the HVAC control mode if the DPT is 20.105				
AC HVAC control mode in	Thermostat function = both heating and cooling Air conditioning application ≠ disabled Type of control mode datapoint = Customized	1 Byte	C-WTU	[20.105] HVAC control mode	78
	Sets the HVAC control mode if the DPT is Customized.				

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
AC HVAC control mode out	Thermostat function = both heating and cooling Air conditioning application = Underfloor panel + split or Only split Type of control mode datapoint = DPT 20.105	1 Byte	CR-T-	[20.105] HVAC control mode	79
	Status of the HVAC control mode if the DPT is 20.105.				
AC HVAC control mode out	Thermostat function = both heating and cooling Air conditioning application = Underfloor panel + split or Only split Type of control mode datapoint = Customized	1 byte	CR-T-	[20.105] HVAC control mode	79
	Status of the HVAC control mode if the DPT is Customized.				

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8.9 Relative Humidity Control

The ***Relative Humidity Control – Humidification*** tab appears only if an room temperature sensor and the relative humidity sensor integrated into the thermostat are enabled.

It contains the following sub-tabs:

- Dehumidification
- Humidification

The sensor measures the humidity of the air in the room, which can be used for various purposes:

- local display and transmission of the value via the bus (for information purposes) using the DPT [9.007] percentage (%);
- use of the measured value to calculate derived psychrometric parameters and transmission of the value via the bus using the DPTs;
- calculation of related indices (perceived temperature) for local display or transmission via the bus;
- use for room ventilation by starting fans, opening external air intakes and opening windows via motorised drives. Control is threshold-based;
- use for controlling the thermo-hygrometric comfort conditions of radiant panel cooling systems equipped with integration for latent heat treatment (activation of dedicated terminals without altering the supply temperature of the cooling water);
- use for the safe control of radiant panel cooling systems not equipped with integration for latent heat management, by calculating critical thermo-hygrometric conditions (dew point) and adjusting the cooling water supply temperature accordingly.

8.9.1 Dehumidification

The secondary ***Dehumidification*** tab contains the following parameters:

- Dehumidification function
- Humidity setpoint [%]
- Humidity hysteresis
- Cyclic sending interval
- Disable dehumidification control from bus
- Signal from bus
- Subordinated to temperature control
- Dehumidification start delay
- Integration
- Temperature difference for integration
- Hysteresis for integration

8.9.1.1 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Dehumidification function		**disabled** cooling only heating only both heating and cooling
	Parameter that selectively enables the dehumidification function.	
Humidity setpoint (for the dehumidification function) [%]	Dehumidification function ≠ disabled	**55** [range 20 … 80]
	Humidity setpoint value for the dehumidification function.	

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Parameter name	Conditions	Values
Humidity hysteresis	Dehumidification function ≠ disabled	**0.8 %** [other values in the range 0.5 … 4%]
	Hysteresis for the dehumidification function.	
Subordinated to temperature control	Dehumidification function = cooling only Cooling Type = floor or ceiling radiant panels	**no** / yes
	Parameter for Dehumidification function = cooling only.	
Dehumidification start delay	Dehumidification function = cooling only Subordinated to temperature control = no	**00:05:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	The value 00:00:00 means that the start delay is not enabled.	
Integration	Dehumidification function = cooling only	**no** / yes
	Parameter for Dehumidification function = cooling only.	
Temperature difference for integration	Dehumidification function = cooling only Integration = yes	**1.5°C** [other values in the range 0.5 … 3°C]
	Parameter for Dehumidification function = cooling only.	
Hysteresis for integration	Dehumidification function = cooling only Integration = yes	**0.5 K** [other values in the range 0.2 K … 3 K]
	Parameter for Dehumidification function = cooling only.	
Cyclic sending interval	Dehumidification function ≠ disabled	**no sending** [other values in the range 30 s … 120 min]
	The value “no sending” means that cyclic transmission is not enabled.	
Disable dehumidification control from bus	Dehumidification function ≠ disabled	**no** / yes
	Allows dehumidification control via a KNX object to be disabled.	
Signal from bus	Disable dehumidification control from bus = yes	**non- nverted** / inverted
	Signal type for dehumidification control via the bus.	

Object name	Conditions	Dim.	Flags	DPT	No. of items per order
Dehumidification command	Dehumidification function ≠ disabled	1 Bit	CR-T-	[1.001] switch	92
	Current status of the dehumidification function (On/Off).				
Dehumidification control disable	Disable dehumidification control from bus = yes	1 Bit	C-W--	[1.002] boolean	93
Dehumidification water battery command	Dehumidification function = cooling only Cooling Type = floor or ceiling radiant panels	1 bit	C-W--	[1.001] switch	94
	This item is enabled only if the temperature control system is set to underfloor heating or radiant ceiling heating. Dehumidification must also be set to cooling only.				

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of items per order*
Dehumidification integration control	Dehumidification function = cooling only Cooling Type = floor or ceiling radiant panels Integration = yes	1 Bit	CR-T-	[1.001] switch	95
	This object is enabled only if the temperature control system is set to underfloor heating or radiant ceiling heating. Dehumidification must also be set to cooling only. *The object is set to ON if, at the same time, the detected relative humidity exceeds the setpoint and the room temperature exceeds the setpoint by the 'Temperature difference for integration activation' value ( ).*				
Relative humidity setpoint for dehumidification	Dehumidification function ≠ disabled	2 bytes	CRWTU	[9.007] humidity (%)	107
	Humidity setpoint value for the dehumidification function.				

8.9.2 Humidification

The ***Humidification*** sub-tab contains the following parameters:

- Humidification function
- Relative humidity setpoint (for humidification control) [%]
- Humidity hysteresis [%]
- Cyclic sending interval
- Disable humidification control from bus
- Signal from bus

8.9.2.1 Communication parameters and objects

Parameter name	*Conditions*	*Values*
Humidification function		**disabled** heating only cooling only both heating and cooling
	Parameter that selectively enables the humidification function.	
Relative humidity setpoint (for humidification control) [%]	Humidification function ≠ disabled	**35** [range 20 … 80 %]
Humidity hysteresis [%]	Humidification function ≠ disabled	**0.8 %** [other values in the range 0.5 … 4%]
	Hysteresis for the humidification function.	
Cyclic sending interval	Humidification function ≠ disabled	**no sending** [other values in the range 30 s … 120 min]
	The value "no sending" means that cyclic transmission is not enabled.	
Disable humidification control from bus	Humidification function ≠ disabled	**no** / yes
	Allows you to disable humidity control via a KNX object.	
Signal from bus	Humidification function ≠ disabled Disable humidification control from bus = yes	**non-inverted** / inverted
	Signal type for humidity control via the bus.	

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Object name	Conditions	Dim.	Flags	DPT	No. of Comm. objects
Humidification command	Humidification function ≠ disabled	1 Bit	CR-T-	[1.001] switch	96
	Current status of the humidification function (On/Off).				
Disable humidification control from bus	Humidification function ≠ disabled Disable humidification control from bus = yes	1 Bit	C-W--	[1.002] boolean	97
Relative humidity setpoint for humidification	Humidification function ≠ disabled	2 bytes	CRWTU	[9.007] humidity (%)	108
	Humidity setpoint value for the humidification function.				

8.10 Comfort

The ***Comfort*** tab is only visible if a room temperature sensor and the integrated relative humidity sensor are enabled.

It contains the following sub-tabs:

- Comfort area
- Calculated psychrometric values

8.10.1 Comfort area

The Comfort area sub-tab contains the following parameters:

- Cyclic sending interval
- Minimum temperature [°C]
- Maximum temperature [°C]
- Minimum relative humidity [%]
- Maximum relative humidity [%]
- Maximum absolute humidity [g/kg × 0.1]

8.10.1.1 Communication parameters and objects

Parameter name	Conditions	Values
Cyclic sending interval	At least one room temperature sensor enabled Relative humidity sensor enabled	**No sending** [other values in the range 30 s … 120 min]
Minimum temperature [°C]	At least one room temperature sensor enabled Relative humidity sensor enabled	**20** [range 0 … 50]
Maximum temperature [°C]	At least one room temperature sensor enabled Relative humidity sensor enabled	**26** [range 0 … 50]
Minimum relative humidity [%]	At least one room temperature sensor enabled	**30** [range 0 … 100]

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Parameter name	*Conditions*	*Values*
	Relative humidity sensor enabled	
Maximum relative humidity [%]	At least one room temperature sensor enabled Relative humidity sensor enabled	**65** [range 0 … 100]
Maximum absolute humidity [g/kg × 0.1]	At least one room temperature sensor enabled Relative humidity sensor enabled	**115** [range 50 … 200]

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Comfort state	At least one room temperature sensor enabled Relative humidity sensor enabled	1 Bit	CR-T-	[1.006] binary value	89
	Value of the 'Comfort status' communication object = 1: the temperature and relative humidity conditions are within the defined comfort zone. *Value of the communication object 'Comfort status' = 0: the temperature and relative humidity conditions are outside the defined comfort zone.*				

Note on the comfort area

It is possible to check whether the measured values for room temperature and relative humidity lie within or outside a defined comfort area, as specified by the parameters on the corresponding tab, and to send the corresponding signal via the bus. The comfort area can be defined, for example:

- in accordance with DIN 1946, leaving the default values of the parameters proposed by the ETS application for T(min), T(max), U.R.(min) and U.R.(max) unchanged;
- by customising the parameter values within the range permitted by the application, based on the intended use of the building or rooms, the geographical area, the activities carried out by the occupants and other factors.

The default values for the comfort area are assumed to be:

- standard maximum temperature 26 °C;
- standard minimum temperature 20 °C;
- standard maximum relative humidity 65%;
- standard minimum relative humidity 30%.

The comfort area defined in this way applies to both the heating and cooling modes.

8.10.2 Calculated psychrometric values

The ***'Calculated psychrometric values'*** sub-tab contains the following parameters:

- Dew point temperature [°C]
- Cyclic sending interval
- Minimum change of value to send [K]
- Temperature to be transmitted in the absence of a request [°C]
- Perceived temperature [°C]

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

Condition for displaying the tab: at least one room temperature sensor enabled and Internal sensors⇒ Relative humidity sensor = enabled.

8.10.2.1 Communication parameters and objects

Parameter name	***Conditions***	***Values***
Dew-point temperature	-	**disabled** / enabled
	Transmitting the dew point temperature value to the bus enables active anti-condensation protection to be implemented, with recalibration of the heat transfer fluid supply conditions, provided that a control device for the mixing unit is present on the bus. If the thermostat is installed in a room where cooling is not required (e.g. a bathroom), it is advisable to exclude the room from the control by setting the Dew Point Temperature parameter to 'disabled'.	
Cyclic sending interval	Dew point temperature = enabled	**no sending** [other values in the range 30 s … 120 min]
Minimum change of value to send [K]	Dew point temperature = enabled	**0.2 K** / no sending [other values in the range 0.2 … 3 K]
Perceived temperature [°C]		**disabled** / enabled
	The value is calculated based on the Humidex index. The correlation is significant for temperatures between 20 and 55 °C.	
Cyclic sending interval	Perceived temperature = enabled	**no sending** [other values in the range 30 s … 120 min]
Minimum change of value to send [K]	Perceived temperature = enabled	**0.2 K** / no sending [other values in the range 0.2 … 3 K]

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. objects***
Dew-point temperature	Dew point temperature = enabled	2 bytes	CR-T-	[9.001] temperature °C	90
Perceived temperature	Perceived temperature = enabled	2 bytes	CR-T-	[9.001] temperature °C	91

Note on perceived temperature

The combined measurement of relative humidity and room temperature allows the calculation of the perceived temperature, which serves as an indicator of thermal discomfort during the summer months. The calculated value can be shown on the thermostat display (if enabled) and/or sent via the KNX bus for display on other bus devices (for example, an ekinex® Touch&Control control and display unit). The method used by the device to calculate the perceived temperature corresponds to the Humidex index.

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8.11 Energy saving

To implement energy-saving functions, contacts can be used to detect when windows are open, along with presence sensors and card slots.

The ***Energy Saving*** tab contains the following sub-tabs:

- Window contacts
- Card Holder

8.11.1 Window Contacts

The ***'Window Contacts'*** sub-tab appears if at least one sensor dedicated to this function is enabled, i.e. if at least one of the following two conditions is met:

1) ⇒ Inputs: Input 1 and/or Input 2 = [DI] windows contact sensor
2) External sensors (from the bus)⇒ Window contact 1 and/or 2 = enabled

Moreover, at least one room temperature sensor must be enabled.

For this function, up to a maximum of four signals can therefore be acquired, which are combined using a logical OR operation.

The ***Window Contacts*** tab contains the following parameters:

- Window contacts function
- Delay time before switch-off

8.11.1.1 Parameters and communication objects

Parameter name	***Conditions***	***Values***
Window contact function		**disabled** / enabled
	Parameter that enables the window contact function.	
Wait time to off mode	Window contact function = enabled	**00:01:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	Time interval before the appliance automatically switches to OFF.	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. objects***
Window contact sensor (from input 1)	Window contact function = enabled, Input 1 = [DI] windows contact sensor	1 bit	CR-T-	[1.019] window/door	26
Window contact sensor (from input 2)	Window contact function = enabled, Input 2 = [DI] windows contact sensor	1 bit	CR-T-	[1.019] window/door	27
Window contact sensor 1 (from bus)	Window contact function = enabled, Window contact 1 = enabled	1 bit	C-W--	[1.019] window/door	43

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Window contact sensor 2 (from bus)	Window contact function = enabled, Window contact 2 = enabled	1 bit	C-W--	[1.019] window/door	44

8.11.2 Card holder

The ***'Card Holder Pocket'*** secondary tab only appears if the corresponding sensor is enabled, i.e. if one of the following (mutually exclusive) conditions is met:

1) Inputs ⇒ Input 1 = [DI] card holder contact sensor or
2) Inputs ⇒ Input 2 = [DI] card holder contact sensor or
3) External sensors (from the bus)⇒ Card holder contact = enabled

Moreover, at least one room temperature sensor must be enabled.

The ***Card Holder*** tab contains the following parameters:

- Card holder function
- When a card is inserted, switch the HVAC mode to
- Activation delay on card insertion
- Switch HVAC mode to upon card removal
- Activation delay upon card removal

8.11.2.1 Parameters and communication objects

Parameter name	*Conditions*	*Values*
Card holder function		**disabled** / enabled
	Parameter that enables the card holder function.	
On card insertion switch to	Card holder function = enabled	none **On**
	Parameter that defines whether, when the card is inserted into the slot, the device should automatically switch to On or remain in its current state.	
Activation delay on card insertion	Card holder function = enabled	**00:00:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	Time interval before automatic switching when the card is inserted into the slot.	
On card removal switch to	Card holder function = enabled	none **Off**
	Parameter defining whether, when the card is removed from the card slot, the device should automatically switch to Off or remain in its current state.	
Activation delay on card removal	Card holder function = enabled	**00:00:00 hh:mm:ss** [range 00:00:00 … 18:12:15]
	Time interval before automatic switching when the card is removed from the slot.	

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Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Card holder contact sensor (from input 1)	Inputs ⇒ Input 1 = [DI] card holder contact sensor Card holder function = enabled	1 bit	CR-T-	[1.018] occupancy	30
Card holder contact sensor (from input 2)	Inputs ⇒ Input 2 = [DI] card holder contact sensor Card holder function = enabled	1 bit	CR-T-	[1.018] occupancy	31
Contact of card holder (from bus)	External sensors (from bus)⇒ Card holder contact = enabled Card holder function = enabled	1 Bit	CR-T-	[1.018] occupancy	45

Note on the card holder function

Information regarding the insertion (or removal) of a card into (or from) the card holder allows direct control of temperature regulation via the room thermostat, whilst transmitting the object value over the bus enables other room functions (lighting, power supply to loads, presence signalling to reception, etc.) to be controlled via KNX, in accordance with the programming carried out using ETS. The temperature setpoint values and the switching mode must be defined in consultation with the facility manager, based on energy-saving objectives and the level of service offered to guests.

<u>Traditional (non-KNX) card holder</u>

With a traditional card holder, the status (card present or absent) of a signalling contact is detected via a thermostat input configured as [DI] card holder contact. In this way, only the insertion and removal of the card can be detected; however, it is not possible to detect access by users with different profiles (guests, service staff, maintenance personnel).

<u>KNX card holder</u>

With a KNX card holder, the type of switching action to be performed can be differentiated; this is achieved not via thermostat parameters, but by defining scenarios that are received by the thermostat. Depending on the device used, advanced functions are possible (e.g. different user profiles).

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8.12 Additional alarms

In addition to the alarms listed in Chapter 11 , up to four external notifications can be configured, which are shown on the display using the ‘alarm triangle’ symbol. It is advisable to provide the user with documentation explaining the meaning of the notification configured in the ETS project. These notifications do not block the thermostat’s control functions.

Unlike the alarms listed in Chapter 11 , which are managed automatically by the device, there is no timeout control for these signals and, consequently, it is not necessary to set up a cyclic transmission.

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***No. of Comm. objects***
Alarm 1 (from bus)	-	1 bit	C-W--	[1.005] alarm	103
	Activates the configurable alarm indicated on the display by the “Alarm Triangle” symbol.				
Alarm 2 (from bus)	-	1 Bit	C-W--	[1.005] alarm	104
	Activates the configurable alarm indicated on the display by the “Alarm Triangle” symbol.				
Alarm 2 (from bus)	-	1 Bit	C-W--	[1.005] alarm	105
	Activates the configurable warning shown on the display via the ‘Alarm Triangle’ symbol				
Alarm 4 (from bus)	-	1 Bit	C-W--	[1.005] alarm	106
	Activates the configurable alarm indicated on the display by the ‘Alarm Triangle’ symbol.				

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8.13 Logic functions

The room thermostat provides useful combinatorial functions of the AND, OR and XOR (exclusive OR) types to implement complex functions within the building automation system. The following are available and configurable:

- 8 logic function channels
- 4 inputs per channel

If desired, a negation operator can be applied individually to each of these objects to invert their value.

For each of the 8 channels, the *'Delay after bus voltage restoration*' parameter has been included: this parameter represents the time interval between the restoration of the bus voltage and the first reading of the input communication objects for the evaluation of the logic functions.

In the event of incorrect connection of the input communication objects or electrical faults on the bus, whereby the request to read the inputs does not return a positive result, the logic output of the corresponding channel can be calculated by setting default values for the inputs.

The communication object representing the output of the logic function is sent over the bus on an event basis, whenever its state changes; alternatively, cyclic transmission at fixed intervals can be set.

8.13.1 Parameters and communication objects

Card activation condition: *General⇒ Logic functions* = enabled.

Parameter name	***Conditions***	***Values***
Logic function		**disabled** / enabled
Logic operation	Logical function = enabled	**OR** / AND / XOR
	XOR (eXclusive OR)	
Delay after bus voltage recovery	Logic function = enabled	**00:00:04.000 hh:mm:ss.fff** [range 00:00:00.000 … 00:10:55.350]
	The time interval between the restoration of the bus voltage and the first read of the input communication objects for the evaluation of the logic functions.	
Output cyclic transmission interval	Logic function = enabled	**no sending** [other values in the range 30 s … 120 min]
	No sending means that the output status of the logic function is updated on the bus only when it changes. Different intervals imply that the output status is transmitted cyclically on the bus.	
Output sending	Logic function = enabled	**Both values** Only value 0 Only value 1
	The output of the logic function is sent to the bus for both values, or only when it is 0 or 1.	
Output update	Logic function = enabled	**At value change** At value or input changes
	The output of the logic function is sent to the bus only when it switches, or also when the inputs change.	
Logic object x	Logic function = enabled	**disabled** / enabled
	x = 1, 2, 3, 4.	
Logical object x negated	Logic function = enabled	**no** / yes

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Parameter name	*Conditions*	*Values*
	Logic object x = enabled	
	By negating the logical state of the corresponding input, it is possible to implement complex combinational logic. Example: Output = (NOT(Logical object 1) OR Logical object 2). *x = 1, 2, 3, 4.*	
Logic object x read at startup	Logic function = enabled Logic object x = enabled	**no** / yes
	x = 1, 2, 3, 4.	
Logic object x default value	Logic function = enabled Logic object x = enabled	**none** / off / on
	x = 1, 2, 3, 4.	

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*No. of Comm. objects*
Logic function x - Input 1	Logic function x = enabled Logic object 1 = enabled	1 bit	C-W-	[1.001] switch	113, 118, 123, 128, 133, 138, 143, 148.
	x = 1, 2, 3, 4.				
Logic function x - Input 2	Logic function x = enabled Logic object 2 = enabled	1-bit	C-W-	[1.001] switch	114, 119, 124, 129, 134, 139, 144, 149.
	x = 1, 2, 3, 4.				
Logic function x - Input 3	Logic function x = enabled Logic object 3 = enabled	1-bit	C-W-	[1.001] switch	115, 120, 125, 130, 135, 140, 145, 150.
	x = 1, 2, 3, 4.				
Logic function x - Input 4	Logic function x = enabled Logic object 4 = enabled	1-bit	C-W-	[1.001] switch	116, 121, 126, 131, 136, 141, 146, 151.
	x = 1, 2, 3, 4.				
Logic function x - Output	Logic function x = enabled	1-bit	C-W-	[1.001] switch	117, 122, 127, 132, 137, 143, 147, 152.
	x = 1, 2, 3, 4.				

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9 List of communication objects

No.	Name of subject of communication	Size	Flag	DataPoint type
0	Technical alarm	1 bit	C-W--	[1.5] DPT_Alarm
2	Leds intensity percentage	1 Byte	C-W--	[5.1] DPT_Scaling
3	Temperature value	2 bytes	CR-T-	[9.1] DPT_Value_Temp
14	Humidity value (1 byte)	1 byte	CR-T-	[5.1] DPT_Scaling
15	Humidity value (2 bytes)	2 bytes	CR-T-	[9.7] DPT_Value_Humidity
16	Temperature threshold 1 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
17	Temperature threshold 2 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
18	Humidity threshold 1 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
19	Humidity threshold 2 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
20	*Various (see Inputs – Parameters and communication objects)*	2 bytes	CR-T-	[9.1] DPT_Value_Temp
21	Temperature threshold 1 sensor 1 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
22	Temperature threshold 2 sensor 1 – Switch	1 it	CR-T-	[1.1] DPT_Switch
23	*Various (see Inputs – Parameters and communication objects)*	2 bytes	CR-T-	[9.1] DPT_Value_Temp
24	Temperature threshold 1 sensor 2 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
25	Temperature threshold 2 sensor 2 – Switch	1 bit	CR-T-	[1.1] DPT_Switch
26	Window contact sensor (from input 1)	1 bit	CR-T-	[1.19] DPT_Window_Door
27	Window contact sensor (from input 2)	1 bit	CR-T-	[1.19] DPT_Window_Door
28	Anticondensation sensor (from input 1)	1 bit	CR-T-	[1.5] DPT_Alarm
29	Anticondensation sensor (from input 2)	1 bit	CR-T-	[1.5] DPT_Alarm
30	Card holder contact sensor (from input 1)	1 bit	CR-T-	[1.18] DPT_Occupancy
31	Card holder contact sensor (from input 2)	1 bit	CR-T-	[1.18] DPT_Occupancy
34	Room temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
37	Antistratification temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
38	Outdoor temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
40	Coil temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
41	Floor temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
42	Flow temperature (from bus)	2 bytes	C-W--	[9.1] DPT_Value_Temp
43	Window contact sensor 1 (from bus)	1 bit	C-W--	[1.19] DPT_Window_Door
44	Window contact sensor 2 (from bus)	1 bit	C-W--	[1.19] DPT_Window_Door
45	Contact of card holder (from bus)	1 bit	C-W--	[1.18] DPT_Occupancy
46	Anticondensation (from bus)	1 bit	C-W--	[1.1] DPT_Switch
47	Weighted temperature	2 bytes	CR-T-	[9.1] DPT_Value_Temp
48	Heating/cooling status out	1 bit	CR-T-	[1.100] DPT_Heat_Cool
49	Heating/cooling status in	1-bit	C-W--	[1.100] DPT_Heat_Cool
50	Enable thermostat command	1 Bit	CRWTU	[1.3] DPT_Enable
51	Enabled thermostat status	1 Bit	CR-T-	[1.11] DPT_State
52	Actual setpoint	2 bytes	CR-T-	[9.1] DPT_Value_Temp
60	Setpoint (heating)	2 bytes	CRWTU	[9.1] DPT_Value_Temp
61	Setpoint (cooling)	2 bytes	CRWTU	[9.1] DPT_Value_Temp
68	Heating out command	1 byte	CR-T-	[5.1] DPT_Scaling

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No.	Name of subject of communication	Size	Flag	DataPoint type
68	Heating out command	1 bit	CR-T-	[1.1] DPT_Switch
68	Heating and cooling out command	1 bit	CR-T-	[1.1] DPT_Switch
68	Heating and cooling out command	1 Byte	CR-T-	[5.1] DPT_Scaling
69	Cooling out command	1 bit	CR-T-	[1.1] DPT_Switch
69	Cooling out command	1 byte	CR-T-	[5.1] DPT_Scaling
70	Auxiliary heating output command	1 bit	CR-T-	[1.1] DPT_Switch
70	Auxiliary heating and cooling output control	1 bit	CR-T-	[1.1] DPT_Switch
71	Auxiliary cooling output command	1 bit	CR-T-	[1.1] DPT_Switch
72	Disable auxiliary heating	1 bit	C-W--	[1.3] DPT_Enable
73	Disable auxiliary cooling	1 bit	C-W--	[1.3] DPT_Enable
74	AC enable in	1-bit	C-W--	[1.1] DPT_Switch
75	AC enable out	1-bit	CR-T-	[1.1] DPT_Switch
76	AC setpoint in	2 bytes	C-W--	[9.1] DPT_Value_Temp
77	AC setpoint out	2 bytes	CR-T-	[9.1] DPT_Value_Temp
78	AC HVAC control mode in	1 byte	C-WTU	[20.105] DPT_HVAC_Control_Mode
79	AC HVAC control mode out	1 byte	CR-T-	[20.105] DPT_HVAC_Control_Mode
80	Fan speed 1	1 bit	CR-T-	[1.1] DPT_Switch
81	Fan speed 2	1 bit	CR-T-	[1.1] DPT_Switch
82	Fan speed 3	1 bit	CR-T-	[1.1] DPT_Switch
83	Fan control disable	1 bit	C-W--	[1.2] DPT_Bool
84	Fan speed in	1 Byte	C-W--	[5.100] DPT_Fan_Stage
85	Fan speed out	1 byte	CR-T-	[5.100] DPT_Fan_Stage
86	Fan speed man/auto in	1 bit	C-W--	[1.2] DPT_Bool
87	Fan speed man/auto out	1 Bit	CR-T-	[1.2] DPT_Bool
89	Comfort state	1-bit	CR-T-	[1.6] DPT_BinaryValue
90	Dew-point temperature	2 bytes	CR-T-	[9.1] DPT_Value_Temp
91	Perceived temperature	2 bytes	CR-T-	[9.1] DPT_Value_Temp
92	Dehumidification command	1 bit	CR-T-	[1.1] DPT_Switch
93	Dehumidification control disable	1 bit	C-W--	[1.3] DPT_Enable
94	Dehumidification water battery command	1-bit	CR-T-	[1.1] DPT_Switch
95	Dehumidification integration control	1 bit	CR-T-	[1.1] DPT_Switch
96	Humidification command	1 bit	CR-T-	[1.1] DPT_Switch
97	Disable humidification control from bus	1 bit	C-W--	[1.3] DPT_Enable
98	Temperature setpoint change lock	1 bit	C-W--	[1.3] DPT_Enable
100	Anticondensation alarm	1 bit	CR-T-	[1.5] DPT_Alarm
101	Rockers lock	1 bit	C-W--	[1.2] DPT_Bool
102	Thermal generator lock	1 bit	C-W--	[1.5] DPT_Alarm
103	Alarm 1 (from bus)	1 bit	C-W--	[1.5] DPT_Alarm
104	Alarm 2 (from bus)	1 bit	C-W--	[1.5] DPT_Alarm
105	Alarm 3 (from bus)	1 bit	C-W--	[1.5] DPT_Alarm
106	Alarm 4 (from bus)	1 bit	C-W--	[1.5] DPT_Alarm
107	Relative humidity setpoint for dehumidification	2 bytes	CRWTU	[9.7] DPT_Value_Humidity

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No.	Name of subject of communication	Size	Flag	DataPoint type
108	Relative humidity setpoint for humidification	2 bytes	CRWTU	[9.7] DPT_Value_Humidity
111	Fan manual speed off status	1 bit	CR-T-	[1.11] DPT_State
113, 118, 123, 128, 133, 138, 143, 148	Logic function x - Input 1	1-bit	C-W--	[1.1] DPT_Switch
114, 119, 124, 129, 134, 139, 144, 149	Logic function x - Input 2	1 bit	C-W--	[1.1] DPT_Switch
115, 120, 125, 130, 135, 140, 145, 150	Logic function x - Input 3	1 bit	C-W--	[1.1] DPT_Switch
116, 121, 126, 131, 136, 141, 146, 151	Logic function x - Input 4	1 bit	C-W--	[1.1] DPT_Switch
117, 122, 127, 132, 137, 143, 147, 152	Logic function x - Output	1-bit	CR-T-	[1.1] DPT_Switch

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10 Control algorithms

The figure shows the components of a generic room temperature control system. The thermostat detects the current temperature of the room air (T_{eff}) and compares it with the desired temperature or setpoint (T_{set}).

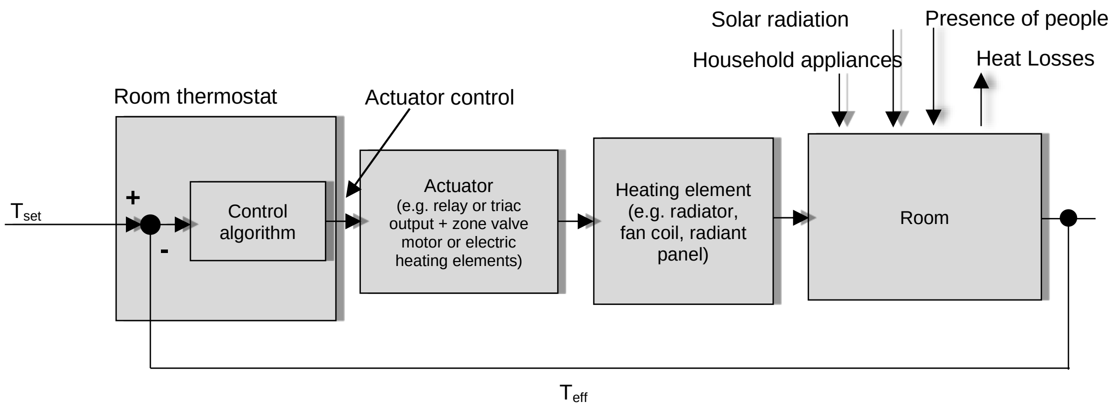

Figure 13 – Generic room temperature control system

The control algorithm, based on the difference between T_{set} and T_{eff}, generates a command which may be either percentage-based or on/off; the command is represented by a communication object that is transmitted via the bus to an actuator device either periodically or upon a switching event. The output of the actuator is the controllable variable of the control system, which may be, for example, a water or air flow rate. The control system implemented by the room thermostat is of the feedback (or closed-loop) type; the algorithm takes into account the effects on the system in order to adjust the magnitude of the control itself.

10.1 2-point control with hysteresis

This control algorithm is very common and is also known as ON-OFF control. The control involves switching the system on and off following a hysteresis cycle. There are two setpoints: one for switching the system on and one for switching it off.

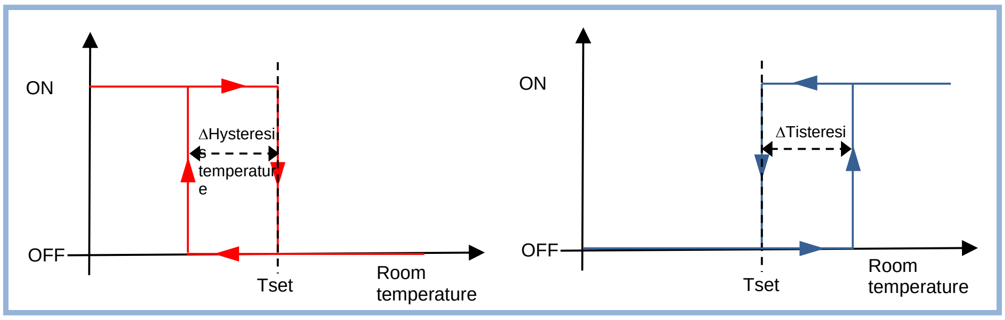

Figure 14 - 2-points hysteresis control

Heating control mode – When the measured temperature is lower than the value (T_{set} – $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$ denotes the heating control differential, the thermostat activates the heating system by sending the relevant telegram to the actuator that controls the terminal; when the measured temperature reaches the value $T_{(set)}$,the thermostat deactivates the heating system by sending the relevant telegram to the actuator. The

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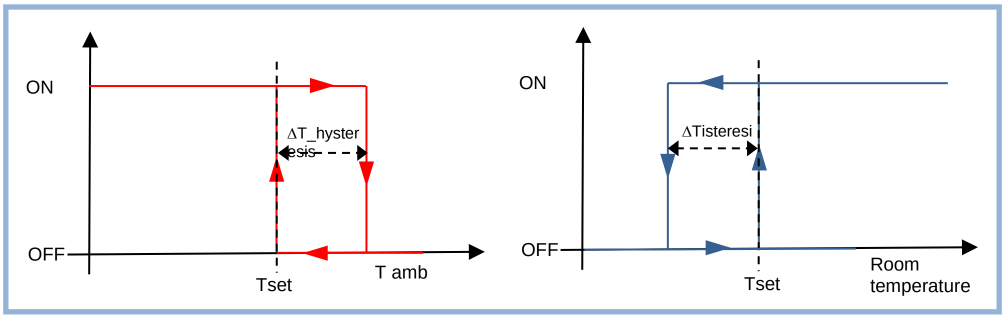
mechanism uses two decision thresholds for the activation and deactivation of the heating system: the first is (T_{set} – $\Delta T_{Hysteresis}$), below which the thermostat activates the system; the second is T_{set} , above which the thermostat deactivates the system.

Cooling mode – When the measured temperature is higher than the value (T_{set} + $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$ denotes the cooling control differential, the thermostat activates the air-conditioning system by sending the relevant telegram to the actuator that controls the terminal; when the measured temperature reaches the value $T_{(set)}$,the device deactivates the air-conditioning system by sending the relevant telegram to the actuator. The mechanism uses two decision thresholds for switching the cooling system on and off: the first is (T_{set} + $\Delta T_{Hysteresis}$), above which the thermostat switches the system on; the second is $T_{(set)}$,below which the thermostat switches the system off.

In the application programme, the hysteresis values for heating and cooling are different: to determine the correct values, the type of system and the system's characteristic thermal inertia must be taken into account.

In applications where underfloor or ceiling radiant panels are used, it is possible to implement a different type of 2-point zone temperature control. This type of control must be combined with a suitable flow water temperature regulation system that takes account of indoor conditions, or with an optimiser that utilises the building's thermal capacity to defer energy inputs. In this type of control, the hysteresis ($\Delta T_{Hysteresis}$) or the room temperature limit (T_{set}+ $\Delta T_{Hysteresis}$) represents the level of deviation from the desired condition that the user is willing to accept during system operation.



Heating operating mode – When the measured temperature is lower than the T_{set}value, the thermostat activates the heating system by sending the relevant signal to the actuator that controls the terminal; when the measured temperature reaches the value (T_{set} + $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$ denotes the heating control differential, the thermostat switches off the heating system by sending the relevant telegram to the actuator. The mechanism uses two decision thresholds for switching the heating system on and off: the first is T_{set} , below which the thermostat switches the system on; the second is (T_{set} + $\Delta T_{Hysteresis}$), above which the thermostat switches the system off.

Cooling mode – When the measured temperature is higher than T_{set} , the thermostat activates the air-conditioning system by sending the relevant telegram to the actuator that controls the unit; when the measured temperature reaches the value (T_{set}– $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$identifies the cooling control differential, the device switches off the air-conditioning system by sending the relevant telegram to the actuator. The mechanism uses two decision thresholds for switching the cooling system on and off: the first is T_{set}, above which the thermostat switches the system on; the second is (T_{set} - $\Delta T_{Hysteresis}$), below which the thermostat switches the system off.

In the application programme, the hysteresis values for heating and cooling are different: to determine the correct values, the system's characteristic inertia must be taken into account.

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In the ETS application programme, the default 2-point hysteresis control algorithm sets the *lower* hysteresis for heating and *the upper hysteresis* for cooling. If the *‘heating type’* and/or *‘cooling type’* parameter is set to *‘underfloor radiant panels’* or *‘ceiling-mounted radiant panels’*, the hysteresis settings can be selected according to the second method described, i.e. with a *higher* hysteresis for heating and *a lower one* for cooling.

The setpoint temperature (T_{set}) is generally different for each of the four operating modes and for the two operating modes of the unit. The values are initially set during configuration using ETS and can be modified subsequently. To optimise energy savings (for every additional degree of room temperature, heat loss to the outside and energy consumption increase by approximately 6%), you can take advantage of the home automation system’s multifunctionality, for example by:

- time-based scheduling with automatic switching of the operating mode by a KNX device acting as a supervisor;
- automatic switching of operating mode based on the presence of people in the room;
- automatic switching of operating mode when windows are opened for ventilation;
- stopping the circulator when thermostat setpoints are met;
- reduction of the flow temperature under partial load conditions.

10.2 Continuous Proportional-Integral Control

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

$$variabile\ di\ controllo(t) = Kp \times errore(t) + Ki \times \int_0^t errore(\tau)d\tau$$

where:

$errore(t) = (Setpoint - Temperatura\ misurata)\ in\ riscaldamento$

$errore(t) = (Temperatura\ misurata - Setpoint)\ in\ raffreddamento$

$Kp = costante\ proporzionale$

$Ki = costante\ integrale$

The control variable consists of a term that depends proportionally on the error and a term that depends on the integral of the error itself.

In practice, derived variables are used, which have a more intuitive meaning.

$$Banda\ Proporzionale\ BP\ [K] = \frac{100}{Kp}$$

$$Tempo\ Integrale\ Ti\ [min] = \frac{Kp}{Ki}$$

The Proportional Band is the error value that determines the maximum output excursion at 100%.

For example, a controller with a Proportional Band of 5 K provides a 100% control output when the setpoint = 20 °C and the measured temperature is ≤ 15 °C in heating mode; in cooling mode, it provides a 100% control output when the setpoint = 24 °C and the measured temperature is ≥ 29 °C. As shown in the figure, a controller with a small Proportional Band tends to produce higher control variable values for small errors compared to a controller with a larger Proportional Band.

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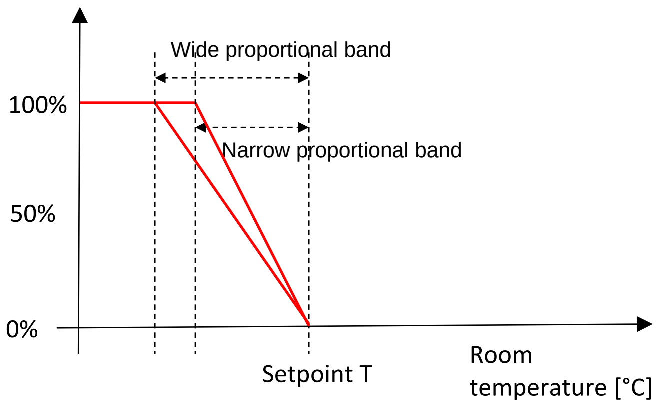

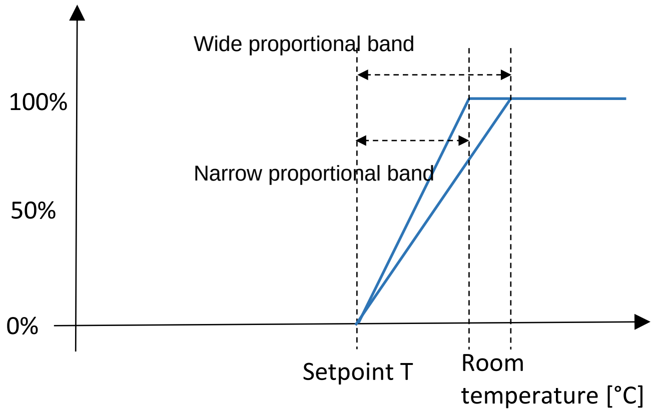

The integral time is the time required for the control variable of a purely proportional controller to return to its setpoint, when the error remains constant over time. For example, with a purely proportional controller in heating mode and a Proportional Band value of 4 K, if the setpoint is 20°C and the measured temperature is 18°C, the control variable takes the value of 50%. With an Integral Time of 60 minutes, if the error remains constant, the control variable will reach 100% after 1 hour; in other words, it will add to the control variable a contribution equal to the value dictated by the proportional contribution alone.

In heating and air-conditioning systems, a purely proportional controller is unable to guarantee that the setpoint will be reached. An integral action must always be introduced to ensure the setpoint is reached: for this reason, the integral action is also known as automatic reset.

10.3 Proportional-Integral PWM Control

The PWM (Pulse Width Modulation) proportional-integral controller is a controller that uses an analogue control variable to modulate the duration of the time intervals during which an associated binary variable is ON or OFF. The controller operates periodically over a cycle period and, during each period, maintains the output at the ON state for a time proportional to the value of the control variable. As shown in the figure, by varying the ratio between the ON time and the OFF time, the average activation time of the output varies and, consequently, the average thermal or cooling power supplied to the environment.

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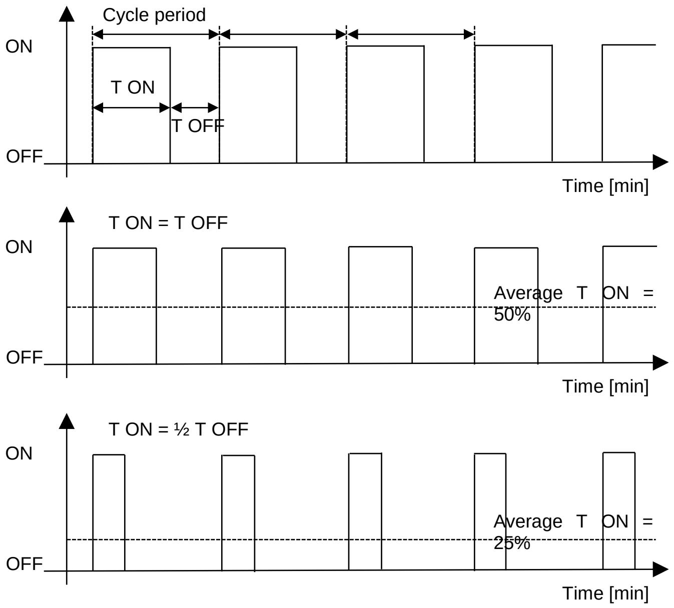

This type of control is suitable for use with ON-OFF actuators, which are lower in cost than proportional actuators, such as electrothermal actuators and servomotors for zone valves.

Among the advantages, it is worth noting that this type of controller eliminates system inertia; it enables energy savings by avoiding unnecessary system interventions caused by 2-point hysteresis control, and only the power required to counteract heat loss from the building is supplied cyclically.

Whenever the setpoint temperature is changed by the user or via the hourly schedule, the cycle time is interrupted, the control output is recalculated and the PWM modulation restarts with a new cycle: this is to speed up the time taken to reach the setpoint.

Terminal type	Proportional Band [K]	Integral time [min]	Cycle period [min]
Radiators	5	150	15–20
Electric heaters	4	100	15–20
Fan coils	4	90	15–20
Underfloor radiant panels	5	240	15–20

The following guidelines are provided for selecting the parameters for a PWM-type proportional-integral controller.

- Cycle period: for low-inertia systems, such as air heating and air-conditioning systems, short periods (10–15 minutes) should be selected to avoid fluctuations in room temperature.
- Narrow proportional band: large and continuous fluctuations in room temperature, short settling time to the setpoint.
- Wide proportional band: small or no fluctuations in room temperature, long settling time to the setpoint
- Short integral time: short settling time to the setpoint, continuous fluctuations around the room temperature setpoint
- Long integral time: long settling time to the setpoint, no fluctuations in room temperature.

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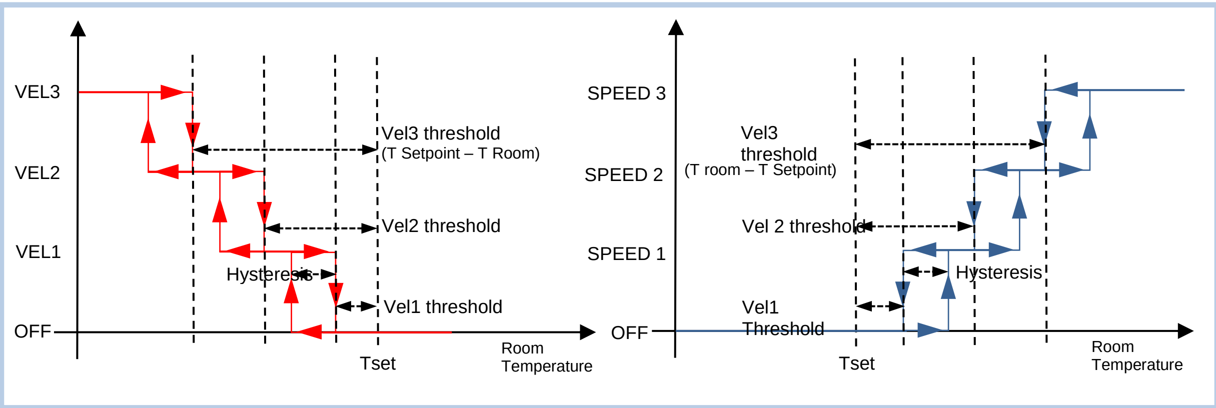
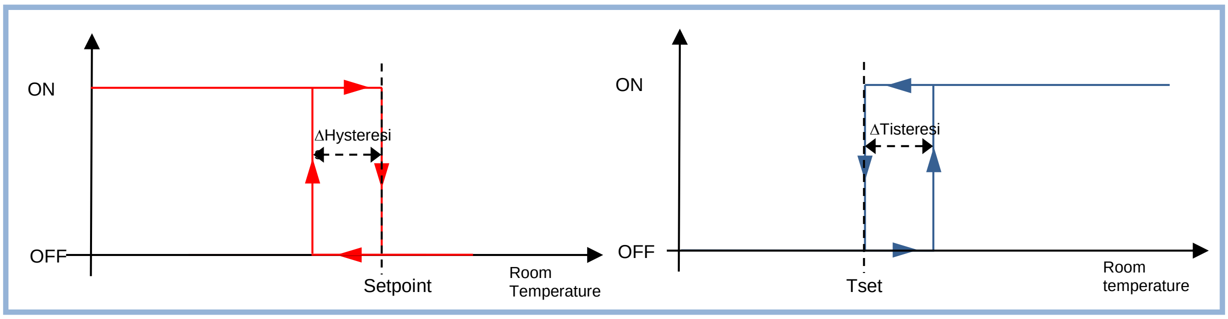
10.4 Fan coil with ON-OFF speed control

This type of fan-coil control is similar to the 2-point hysteresis control analysed in the previous section: the fan speed is switched on or off based on the difference between the setpoint temperature (T_{set}) and the measured temperature (T_{amb}). The key difference from the 2-point hysteresis algorithm is that, in this case, there is not just a single stage on which the hysteresis cycle is carried out by setting the on and off thresholds for the speeds, but there may be three (depending on the number of fan-coil speeds). This means that each stage corresponds to a specific speed, and when the difference between the measured temperature and the setpoint temperature triggers the activation of an additional speed, the other two speeds must be deactivated before the new speed is activated, in order to prevent damage to the fan motor.





The diagram in the top left-hand corner of the graph refers to the speed control of the fan coil unit with three operating stages for heating. Looking at the graph, it can be seen that there is a hysteresis cycle for each stage, and that two thresholds are assigned to each speed, determining when it is switched on and off. The thresholds are determined by the values set in the application programme and can be summarised as follows:

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

The *'Speed control hysteresis'* parameter in the ETS application programme represents the hysteresis value common to all speed stages and is the same for both heating and cooling.

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As regards the shut-off valve for the water coil (2-pipe system) or the shut-off valve for the heating water coil (4-pipe system), a 2-point hysteresis algorithm can be used, which, in the application programme, acts on the same setpoints. If the room temperature is lower than the value (T_{Set}–Δ $T_{Hysteresis}$), the device sends a command to activate the valve; the shut-off valve is deactivated, however, when the room temperature reaches the value of $T_{(Set),}$and fan speed 1 is also deactivated at the same time. This also prevents the formation of ‘air puffs’ on the walls caused by water circulation within the coil without convective heat transfer.

The diagram in the top right-hand corner of the graph refers to the control of fan-coil speeds with three operating stages for air conditioning. Looking at the graph, it can be seen that there is a hysteresis cycle for each stage, and that two thresholds are assigned to each speed, determining its activation and deactivation. The thresholds are determined by the values set in the application programme and can be summarised as follows:

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

As regards the shut-off valve for the water coil (2-pipe system) or the shut-off valve for the air-conditioning water coil (4-pipe system), a 2-point hysteresis algorithm may be used, which, within the application programme, acts on the same setpoints. If the room temperature exceeds the value (T_{Set}+Δ $T_{Hysteresis}$) the device sends a command to activate the valve; the shut-off valve is deactivated, however, when the room temperature reaches the value of $T_{(Set),}$and fan speed 1 is also deactivated at the same time.

Both figures refer to the 3-speed control of the fan coil, as the explanations provided here are comprehensive; for 2-speed or single-speed systems, the operation is the same, with the sole difference being that not all speeds will be controlled.

It should be noted that in fan-coil applications where both heating and cooling are active, the speed activation thresholds are the same in both operating modes of the system.

To coordinate the operation of the fan with the shut-off valve on the heat exchanger coil, care must be taken with the selected hysteresis values: for example, if the parameters *‘First speed threshold* = 0K’ and *‘Speed control hysteresis* = 0.3K’ are selected in the *Ventilation* tab, the *‘Hysteresis* = 0.3K’ parameter must also be set in the *Heating* and/or *Cooling* tabs to ensure that the valve on the heat exchanger coil is open when speed 1 is activated.

A further element of flexibility is the option to make manual ventilation operation dependent on the desired temperature T_{Set}being reached. By selecting the parameter *‘Manual operation* = *temperature*-independent’ in the *Ventilation* tab in ETS, the ventilation will continue to operate at the speed set by the user even once the desired temperature has been reached; conversely, with the setting in ETS *‘Manual operation* = *temperature-dependent*’, the ventilation controlled manually by the user will still be stopped once the desired conditions are met.

Communication between the controller and the actuator can be achieved either via [1.1] DPT_Switch communication objects (80-81-82, Fan speeds 1-2-3) or via a single [5.100] DPT_Fan_Stage object (84, Fan

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speed IN). It should be noted that the object (84, Fan Speed IN), with ON/OFF fan-coil speed control, does not vary continuously but only assumes discrete values, in accordance with the hysteresis of the ON/OFF windows defined by the thresholds, as shown in the following table.

Automatic fan speed	Fan speed communication objects, type [1.1] DPT_Switch			Communication object: Fan speed out, [5.100] DPT_Fan_Stage
	V1	V2	V3	
Control type: continuous				
OFF	-	-	-	0
1	-	-	-	1
2	-	-	-	2
3	-	-	-	3
4	-	-	-	4
5	-	-	-	5
Control type: 3 speeds				
OFF	0	0	0	0
1	1	0	0	1
2	0	1	0	2
3	0	0	1	3
Control type: 2 speed				
OFF	0	0	-	0
1	1	0	-	1
2	0	1	-	2
Control type: 1 speed				
OFF	0	-	-	0
1	1	-	-	1

Figure 15 - Values of communication objects for hydronic ventilation

If an air-conditioning interface is enabled, the table is as follows:

Fan speed in automatic mode	Communication objects: Fan speed out, [5.001] DPT_Percentage	Communication object: Outgoing fan speed, [5.100] DPT_Fan_Stage
Control type: continuous control		
OFF	0 %	0
1	20 %	1
2	40 %	2
3	60 %	3
4	80 %	4
5	100 %	5
Control type: 3 speeds		
OFF	0 %	0
1	33 %	1
2	67 %	2
3	100 %	3

Figure 16 - Values of communication objects for ventilation in AC mode

During switching, before the new speed is activated, the other speeds must be deactivated to avoid damaging the fan motor (interlocked output): both binary and continuous-type communication objects are therefore all set to the OFF value (0 %) before being updated by the internal controller to the next speed.

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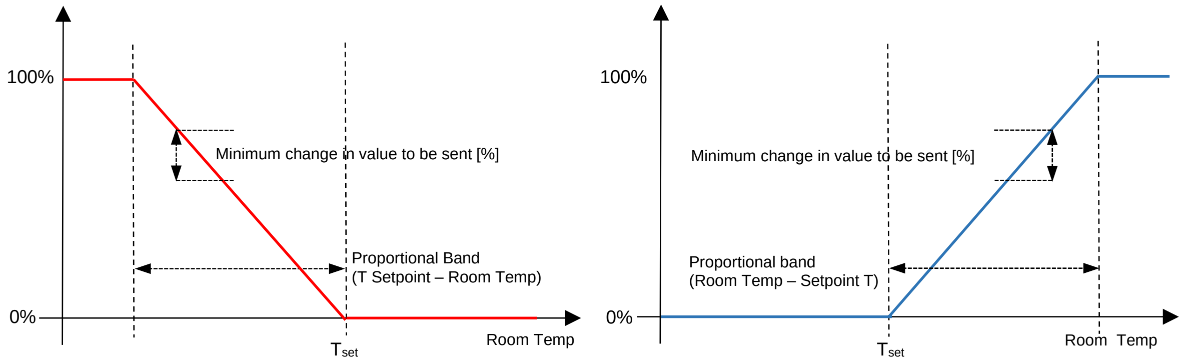
10.5 Fan coils with continuous- fan speed control

In this type of control, no independent 1-bit communication objects are used; instead, a single 1-byte communication object (DPT 5.100 Fan stage) is used: this means that it is not necessary to deactivate the other speeds before activating a new one.



Hysteresis levels must be set directly on the fan-coil actuator. The application software provides the *Proportional Band* parameter, which has the same value for both heating and cooling: this parameter determines the response slope of the fan. The *Minimum change in value to be sent* [%] parameter is set to limit telegram traffic on the bus.

i The *'Fan Speed Out'* (95) communication object, with a size of 1 Byte, varies continuously according to the characteristic shown in the figure. Refer to the previous paragraph to assess the differences compared with 1-2-3-speed fan control, in which the same communication object instead takes on discrete values.

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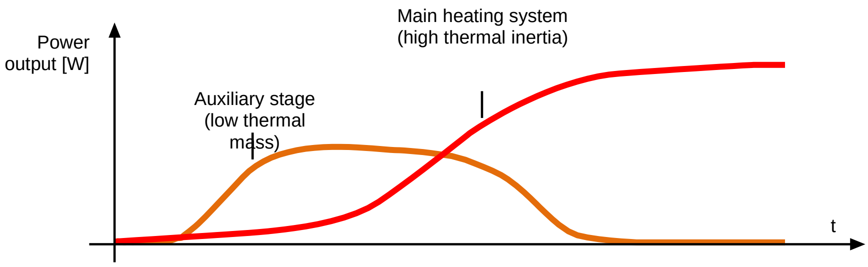
10.6 2-point control with hysteresis per stage r auxiliary

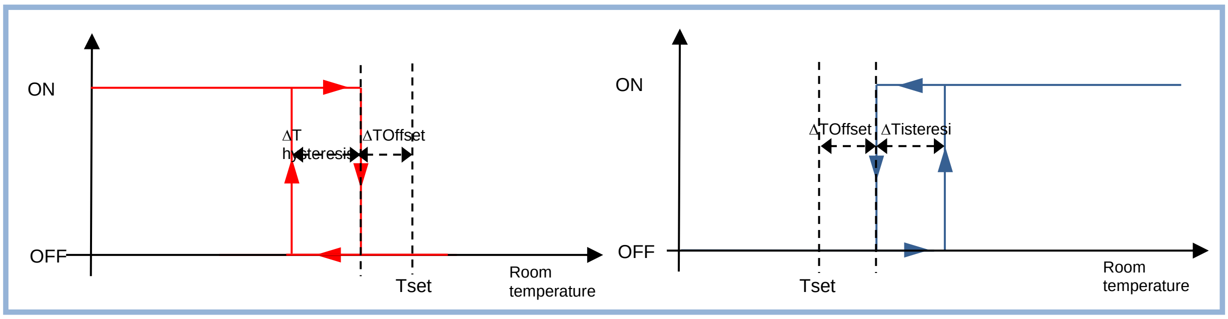
Heating and cooling systems exhibit varying degrees of high inertia depending on the type of thermal energy transfer. To reduce the time taken to reach comfort conditions, a heating/cooling system with lower inertia can be used; this can support the main system during the start-up phase when the difference between the setpoint temperature (T_{set}) and the measured temperature (T_{amb}) remains significant.



The system, defined as the second stage or auxiliary stage, helps to heat or cool the room during the initial phase and then ceases operation once the difference between $T_{set}$and T_{amb}can be satisfactorily managed by the main system alone. The auxiliary stage is generally controlled using a 2-point control algorithm with hysteresis.

<u>Heating mode</u>

When the measured temperature (T_{room}) is lower than the value (T_{set} – ΔT_{Offset}– $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$identifies the heating control differential, the thermostat activates the auxiliary heating stage by sending the relevant telegram to the dedicated actuator; when the measured temperature reaches the value of (T_{set} – ΔT_{Offset}), the device deactivates the auxiliary heating system by sending the relevant telegram to the actuator.



<u>Cooling control mode</u>

When the measured temperature exceeds the value (T_{set} + ΔT_{Offset} + $\Delta T_{Hysteresis}$), where $\Delta T_{Hysteresis}$ identifies the cooling control differential, the device activates the auxiliary cooling system by sending the relevant telegram to the dedicated actuator; when the measured temperature reaches the value (T_{set} + ΔT_{Offset}), the device deactivates the auxiliary cooling system by sending the relevant telegram to the actuator.

10.7 Auxiliary stage with fan coil

Of particular interest is the system configuration in which a radiant underfloor panel – a high-inertia system acting on the building's structural masses – is combined with an auxiliary fan-coil system that acts on the air volumes: the EK-EM2-TP room thermostats can be easily configured for this type of application.

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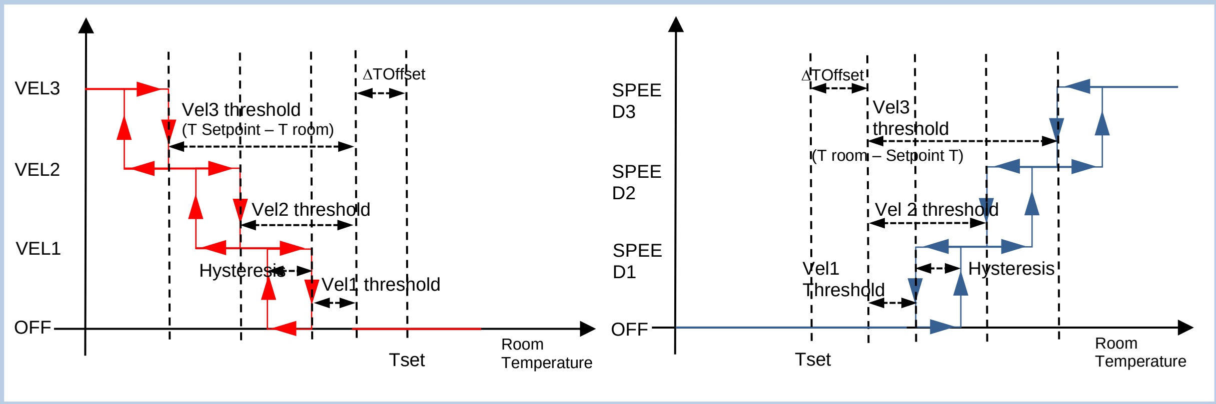

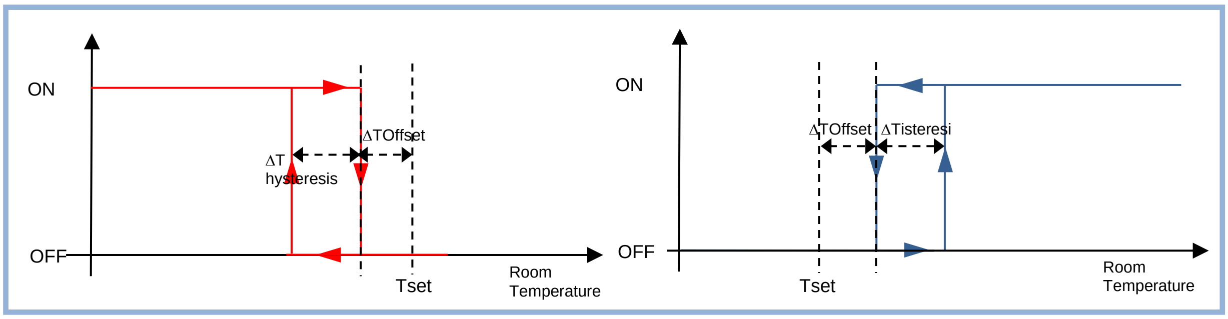

As regards the configuration of the secondary stage, the same considerations apply as those set out in the section on fan-coil control with ON/OFF or continuous speed control. Of particular importance is the secondary stage intervention offset, ΔT_{Offset}, which corresponds to the parameter *'Offset from setpoint*' in the *Heating* and/or *Cooling* tab. By setting *'Offset from setpoint'* (which can be differentiated between heating and cooling if the control communication objects are separate) to 0 K, the radiant panel and the fan coil operate as two heating and/or cooling units in parallel. If, on the other hand, the *'Offset from* setpoint' > 0 K, the fan coil unit intervenes quickly during the initial stages of bringing the room up to temperature, leaving it to the radiant panel to bring the room to the desired temperature.

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11 Diagnostics

Alarm code	Cause
A01	Surface temperature exceeded
A02	Condensation forming
A03	Boiler lockout alarm
F01	Alarm 1 (from the bus)
F02	Alarm 2 (from the bus)
F03	Alarm 3 (from the bus)
F04	Alarm 4 (from the bus)
Error code	**Cause**
E00	Integrated temperature sensor fault
E01	Built-in relative humidity sensor fault
E06	Analogue input 1: generic NTC probe fault
E07	Analogue input 1: additional room temperature sensor faulty
E08	Analogue input 1: fan coil flow temperature sensor faulty
E09	Analogue input 1: Radiant floor surface temperature sensor faulty
E10	Analogue input 1: outdoor temperature sensor faulty
E11	Analogue input 1: antistratification temperature sensor faulty
E14	Analogue input 2: generic NTC sensor faulty
E15	Analogue input 2: additional room temperature sensor faulty
E16	Analogue input 2: fan coil flow temperature sensor faulty
E17	Analogue input 2: Radiant floor surface temperature sensor faulty
E18	Analogue input 2: outdoor temperature sensor faulty
E11	Analogue input 2: antistratification temperature sensor faulty
E34	OC: Outdoor temperature sensor timeout
E35	OC: Additional room temperature sensor timeout
E36	OC: Fan coil supply air temperature sensor timeout
E37	OC: Radiant floor surface temperature sensor timeout
E38	OC: System flow temperature sensor timeout
E40	OC: Anti-stratification temperature sensor timeout
E41	OC: Anti-condensation sensor timeout
E42	OC: Window contact 1 timeout
E43	OC: Window contact 2 timeout
E44	OC: Presence sensor 1 timeout
E45	OC: Presence sensor 2 timeout
E46	OC: Card slot contact timeout

Table of displayable error and alarm codes.

Alarms F01 … F04 are triggered by communication objects; as they have no predefined meaning, they must be documented by the system integrator in the project documentation.

12 Warnings

- Installation, electrical connection, configuration and commissioning of the device must only be carried out by qualified personnel.
- Opening the device housing will immediately invalidate the warranty.

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12.1 Return of defective devices

Devices with faults or defects may be returned for repair or replacement by following the procedure described below.

12.1.1 Devices purchased directly from ekinex®

You must first contact ekinex®technical support by sending an email to support@ekinex.com with the following information (mandatory):

- Exact model of the device
- Serial number (found on the label attached to the product)
- Date and/or details of the purchase document
- A precise and as detailed as possible description of the fault or problem

ekinex® technical support will contact the customer promptly, as appropriate, to investigate the issue further, suggest possible solutions or authorise the return of the device for repair or replacement.

Devices must be sent to the following address:

EKINEX S.p.A. - Via Novara, 37 - I-28010 Vaprio d'Agogna (NO) - Italy

Any further instructions will be agreed with technical support during the support process.

12.1.2 Devices purchased through retailers

For assistance regarding devices purchased through retailers, please contact the retailers' technical support department.
Depending on the nature of the problem and any other factors, at the sole discretion of ekinex®and in agreement with the retailer, the customer may be advised to contact ekinex®directly following the same procedure as above.

13 Further information

- This application manual is intended for installers, system integrators and designers.
- For further information on the product, please contact the ekinex® technical support at the following email address: support@ekinex.com or visit the website www.ekinex.com
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