Application manual
KNX Room Temperature controller
71 series EK-E72-TP

Index

Revision	Updating	Date
3.00	ETS application version: VER 3.00. Modified features: ⇒ Communication objects added: *74 Building protection HVAC mode active* *75 Fan manual speed percentage* *76 Fan manual speed off status*	20/03/2017
2.00	ETS application version: VER 2.00. Modified features: ⇒ *Heating/cooling status out* and *Heating/cooling status in* communication objects *(more enhanced management)*	20/06/2016
1.00	Emission	10/03/2016

The latest revision of the application manual is available at www.ekinex.com. For previous revisions, contact the technical support at support@ekinex.com.

Foreword

The present document describes the ekinex® KNX room temperature controller with LCD display 71 series version EK-E72-TP.

1 General information

The device described in the present document works as an electronic digital temperature controller for a room or a zone (consisting e.g. in a group of rooms or a whole floor) of a building and is part of the secundary regulation for heating and cooling. The room temperature controller was developed according to the KNX standard for use in systems of control of homes and buildings.

Through the integrated sensor, the device can measure directly the room temperature value that can be used for control and regulation tasks of heating, cooling and ventilation. Via the bus the device can furthermore receive temperature values from other bus devices. The integrated display visualizes a series of information concerning the room controller function. The device is provided with two rockers that can be used for controlling the thermostat function. The device, if configured to receive a room relative humidity value by the bus, can also report if the room or the zone are in a configurable thermal comfort range, depending on the building intended use, activity and other specific factors.

1.1 Function

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

1.2 Main functional features

The main functions carried out by the device are:

- temperature measuring with possibility of sending the values on the bus;
- 2-points (on/off) or proportional (PWM or continuous) room temperature regulation;
- ventilation control with continuous or 3-speed regulation;
- relative humidity regulation by humidification or dehumidification if a relative humidity value is acquired by a KNX probe;
- seasonal modes: heating and cooling with local or via bus switch-over;
- operating modes: comfort, standby, economy and building protection with separate setpoint values for heating and cooling;
- manual or automatic control of a fan-coil unit with 2-pipes or 4-pipes connection;
- automatic switching of the operating mode when presence/absence of people or window opening is detected;
- weighted average of two temperature values;
- temperature displaying (measured, setpoint and outdoor values in °C or °F), alarms and errors (with alphanumeric codification);
- signaling opening windows;
- limitation of the surface temperature for floor heating radiant panels;

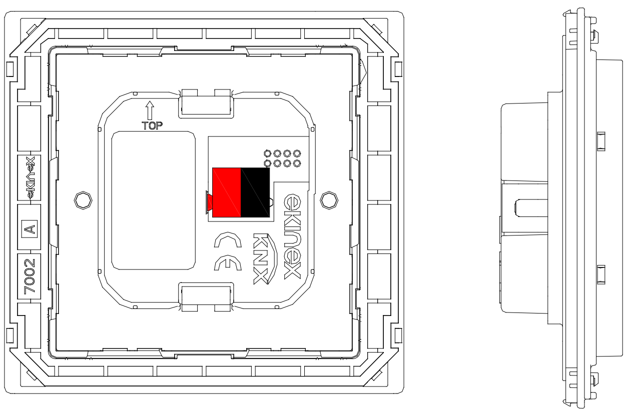
- anticondensation protection for floor and ceiling cooling radiant panels;
- antistratification function;
- delayed fan start ("hot-start" function) time-scheduled or depending on the conveying fluid temperature measured at the coil battery;
- Comfort area (configurable) internal or external condition sending on the bus;

1.3 Technical data

Feature	Valore
Device	KNX S-mode bus device
Communication	according KNX TP1 standard
Use	dry internal rooms
Environmental conditions	• Operating temperature: - 5 ... + 45°C • Storage temperature: - 25 ... + 55°C • Transport temperature: - 25 ... + 70°C • Relative hunidity: 95% not condensating
Power supply	SELV 30 Vdc from bus KNX (auxiliary power supply not necessary)
Current consumption from bus	< 13 mA
Switching elements	4 frontal capacitive touch buttons. Direct access to 4 independent functions trough short press (< 5 s). Indirect access to other functions by long press (> 5 s).
Programming elements	1 pushbutton and 1 LED (red) on the front side
Display elements	1 backlighted LCD display
Temperature sensor	1 integrated NTC-type
Installation	On round or square wall-mounting box with distance between fixing holes of 60 mm
Connection	• bus: black/red KNX terminal block
Protection degree	IP20
Dimensions (WxHxD)	81 x 77 x 24 mm

1.4 Design

The device is realised for wall-mounting on round or square wall box with distance between fixing holes of 60 mm. The programming pushbutton and the programming led are on the front side under the transparent display protection screen. On the rear side of the housing there is the terminal block for the connection of the bus.



Device execution: frontal and lateral view

1.5 Delivery

The delivery includes the metallic support for mounting on the round 60 mm wall box, the screws (2 pairs), a plastic adapter and the terminal block for the connection of the bus. The plate and the frame (if present) must be ordered separately. For further information please refer to ekinex® product catalog or visit www.ekinex.com.

1.6 Accessories

The device is completed with a 1 or 2 place plate, in combination with another series 71 device or a civilian 55x55 mm series component, that have to be ordered separately. An ekinex® Form o Flank frame is also required (except for 'NF - No Frame version).

<table>
<tr><th>Code</th><th>Mounting</th><th>plate</th><th>Adapter</th><th>Frame</th></tr>
<tr><td>EK-E72-TP</td><td>With frame Form or Flank series</td><td rowspan="3">EK-PQS-…, 1 place, 60x60
EK-P2G-…, 2 places, 55x55, 60x60
EK-P2S-…, 2 places, 60x60</td><td></td><td>Flank or Form, 1-2 places</td></tr>
<tr><td>EK-E72-TP-NF</td><td>Without frame ('NF series), with black side profile</td><td rowspan="2">EK-TAQ-…, 1 place
EK-A71-…, 2 places</td><td></td></tr>
<tr><td>EK-E72-TP-NFW</td><td>Without rame ('NF series), with white side profile</td><td></td></tr>
</table>

Accessories of the device: set of rockers and frames

1.7 Marks and certification

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

2 Installation

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

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

The device can only be mounted on a round or square wall flush mounting box with 60 mm distance between fixing holes. If necessary, the metallic support for mounting on the wall box can also be ordered separately.

2.1 Connection

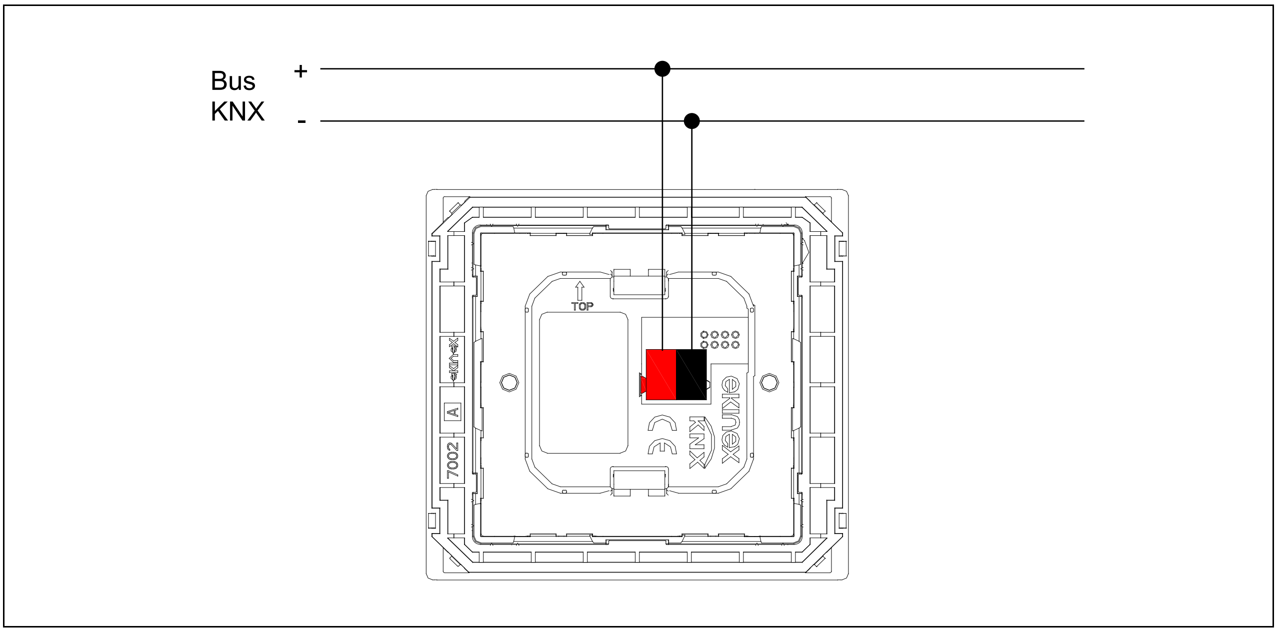
For the operation the device has to be connected to the bus line and addressed, configured and commissioned with ETS (Engineering Tool Software).

Connection of the bus line

The connection of the KNX bus line is made with the terminal block (red/black) included in delivery and inserted into the slot of the housing.

Characteristics of the KNX terminal block

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



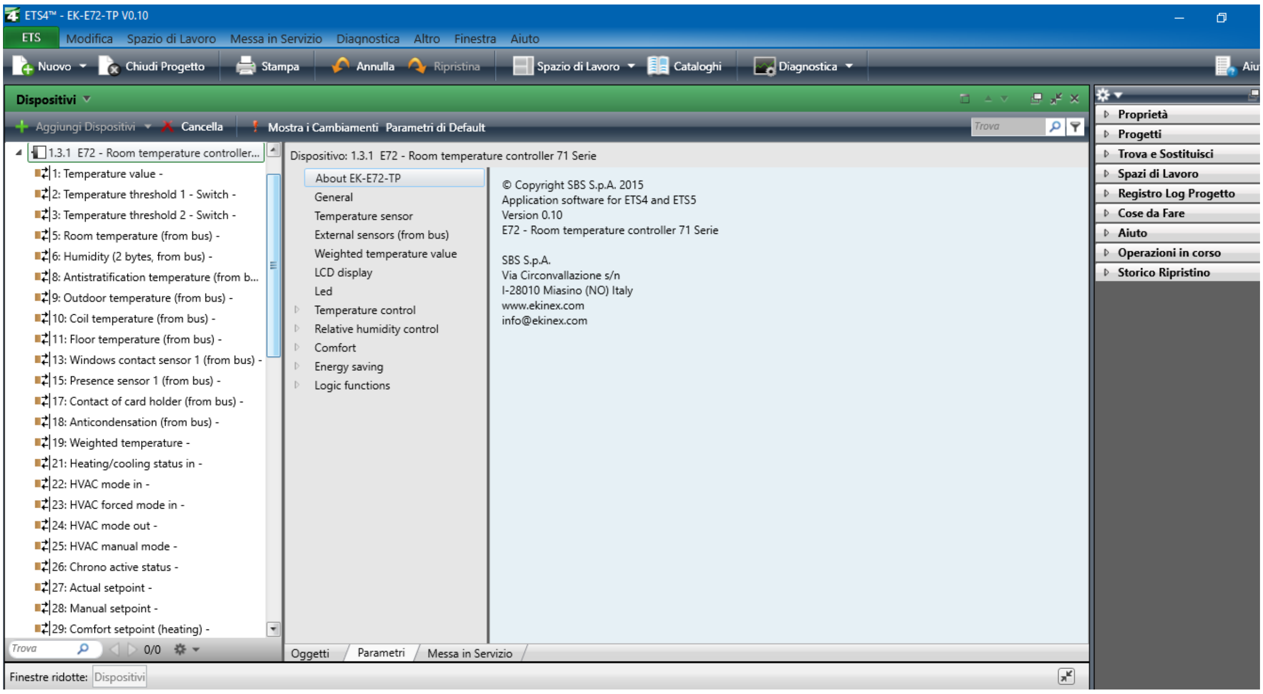
Connection of the device of the bus line

3 Configuration and commissioning

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

3.1 Configuration

The device functionality is defined by the settings done via software. The configuration requires necessarily ETS4 (or later releases) and the ekinex® APEKE72TP##.knxprod (## = release) application program that can be downloaded from the website www.ekinex.com. The application program allows the configuration of all working parameters for the device. The device-specific application program has to be loaded into ETS or, as alternative, the whole ekinex® product database can be loaded; at this point, all the instances of the selected device type can be added to the project. The configurable parameter details are described in this application manual.



Application program for ETS APEKE72TP##.knxprod (## = version)

3.1.1 Tree structure of the application program

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

- About EK-E72-TP
- General
- Temperature sensor
- External sensors (from bus)
- LCD Display
- LED
- Temperature control
  - Settings
  - Heating
- Relative humidity control
- Comfort
  - Comfort area
  - Calculated psychrometric values
- Energy saving
  - Windows contacts
  - Presence sensors
  - Card holder
- Logic functions

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

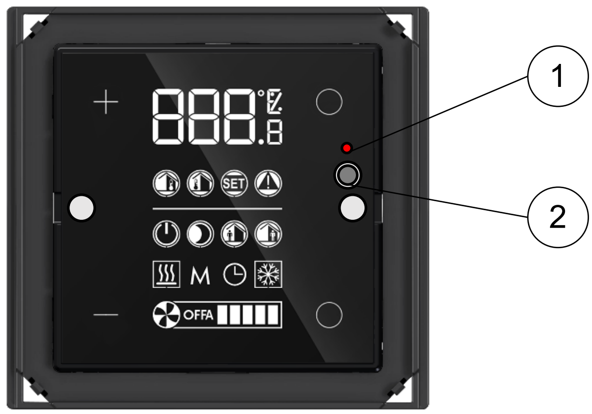
3.1.2 Languages of the application program

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

3.2 Commissioning

For the commissioning the device is provided on the front side (in the area usually occupied by the rockers) of:

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



Device programming: led (1) and pushbutton (2)

Important! During commissioning, the device performs a starting phase consisting in a self-calibration of the capacitive keys. It is recommended to connect the bus terminal avoiding to manipulate the thermostat in the front or otherwise interfering with the keys: this can lead to unexpected reactions to key pressing during normal operation of the device.

For commissioning the device the following activities are required:

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

When downloading the application program the display shows "PrOg" and the flashing symbol of the clock. At the end of the download the operation of the device automatically returns to normal mode; in this mode the programming LED is turned off. Now the bus device is programmed and ready for use.

3.2.1 Displaying physical address and firmware release

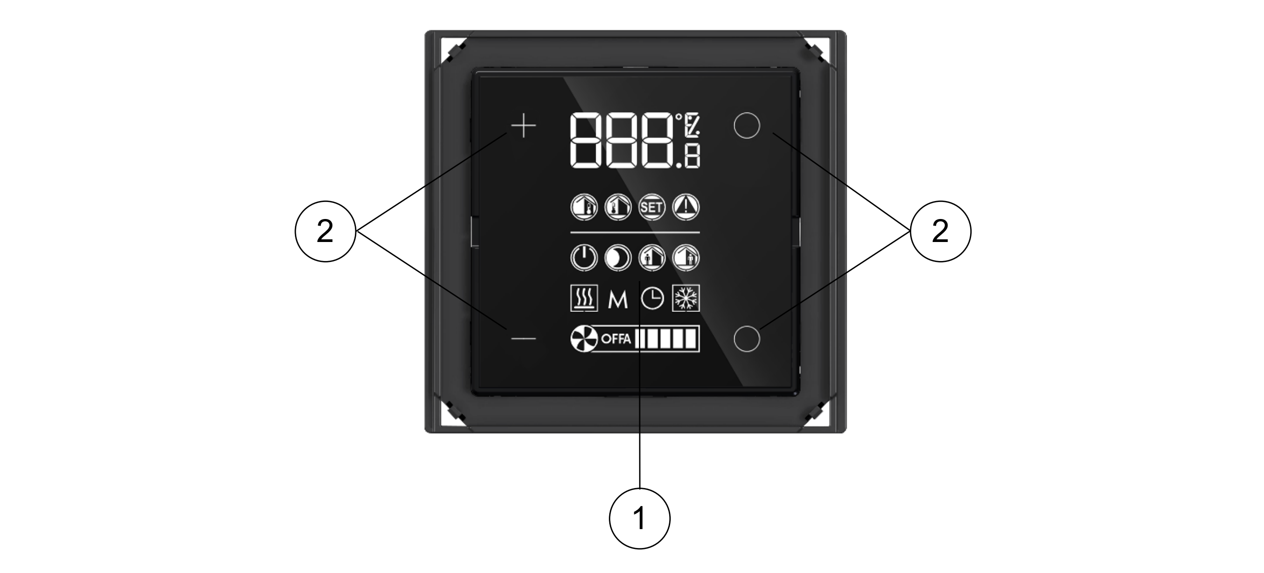
Once the first addressing is done, you can check anytime the physical address and the firmware release directly on the device display. In order to display it, press for more than 3 seconds the – (minus) symbol on the lower-left touch button and the ° (circle) symbol on the upper-right touch button. All segments of the display are turned off; displaying a physical address only the 3 large digits and the small one are active. The information displayed in sequence are: the area number (A), the line number (L), the device number (d) and the firmware release (F). To scroll through the three elements of the physical address press + or –. For example:

Example of displaying the physical address 10.5.43 (device nr. 43, installed on the line 5 of the area 10) and the firmware release 001

To exit from the physical address displaying press shortly (< 3 seconds) the ° symbol on the lower right side. If you elapse of time interval set in parameter “Time to exit change without saving” without pressing any rocker, the device returns automatically to the previously displayed information.

4 User interface

The user interface of the room temperature controller includes a LCD display and 4 capacitive touch pushbuttons located near the angles of the plastic case.



User interface: LCD display (1), toch buttons (2)

The symbols on the rockers recall the function carried out:

+ temperature or fan speed increase;

– temperature or fan speed decrease;

O information sequence, operating mode change, ventilation control, seasonal change-over.

Through a combined pressure of various symbols other functions can be carried out.

4.1 LCD display

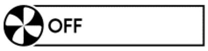
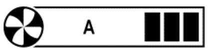
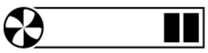
The device is provided with a LCD display (1) with adjustable backlight that occupies a vertical area of approx. 28 x 48 mm (WxH) in the central area of the device. Thanks to the integrated brightness sensor, you can set the automatic adjustment of the backlight intensity according to the room brightness conditions.

4.1.1 Information displaying

Depending on the configuration done with ETS, the connections and the availability of information (local or received from the bus), the series of symbols allow to display:

- room actual temperature (it may be the temperature calculated using a weighted average of two values);
- outdoor temperature, preceded by a – (minus) sign in case of outdoor temperature below 0°C;
- room relative humidity value (%, without decimals);
- preceived temperature (calculated using actual temperature and relative humidity);
- temperature setpoint (for the actual operating mode);
- alarm and error condition (A01, A02… E01, E02…);
- window opening;

- operating mode (comfort / standby / economy / building protection);
- seasonal mode (heating / cooling);
- device status calling / not calling (or setpoint reached / not reached);
- operation in manual mode (M);
- operation as slave device (clock);
- fan status (1-2-3-automatic-off), when present;
- device physical address assigned by ETS.

Display symbols			
	Digits (for numeric values display)		Heating mode active (device not calling or setpoint reached)
	Celsius degrees		Heating mode active (device calling or setpoint not reached)
	Fahrenheit degrees		Manual operation (M)
	Percentage (relative humidity)		Cooling mode active (device not calling or setpoint reached)
	Indoor temperature		Cooling mode active (device calling or setpoint not reached)
	Outdoor temperature		Slave (operation subordinated to a supervising KNX device)
	SET		OFF (fan-coil switched off)
	Alarm		Automatic fan-coil operation (example: speed 3)
	Building protection operating mode (off)		Manual fan-coil operation (example: speed 2)
	Economy operating mode (night)		
	Standby operating mode		
	Comfort operating mode		

Symbols that can be activated on the LCD display

4.1.2 Segment test

The segment test allows you to check at any time the proper functionality of the display. In order to do the test, press simultaneously + (plus) on the upper-right side and the symbol O on the lower-left side for more than 3 seconds. All symbols are activated simultaneously; then all the symbols are turned off. In the test phase keep available the instructions or the user guide.

If you elapse the time set in the parameter "Time to exit change without saving" (General folder) without pressing a button, the device will return to the previous situation.

4.1.3 Backlight

The backlight intensity of the LCD display is adjustable. The first setting is done when configuring the device using ETS, but the intensity can be changed later at any time.

To access the change press simultaneously + (plus) and O on theupper-righ side for more than 3 seconds. All symbols are turned off except the digits and the percentage symbol. The actual value (as a percentage) of backlight intensity is displayed. At each pressing of + or – the intensity is increased or decreased by 5%. To confirm the selected intensity press shortly (< 3 seconds) the O symbol either on the upper-right side. Three rapid flashes of the digits indicate that the new value was saved. If you elapse of time interval set in the "Time to exit change without saving " (General folder) without pressing any rocker, the device returns to the previous situation.

5 Temperature sensor

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

Positioning of the sensors: temperature (1)

The temperature sensor (not to be seen in the drawing) is located under the plastic half-shell.

6 Input variables

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

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

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

Data	Coming from	Description
Room temperature	Internal sensor	Analogic value for thermoregulation functions
Room brightness	KNX bus (through communication objects)	Object 4 (from bus)
Room temperature		Object 5 (2 bytes)
Room relative humidity		Objects 7 (1 byte or 2 bytes)
Antistratification temperature		Object 8 (2 bytes)
Outdoor temperature		Object 9 (2 bytes)
Exchange coil temperature		Object 10 (2 bytes)
Floor surface temperature		Object 11 (2 bytes)
Conveying fluid flow temperature		Object 12 (2 bytes)
Presence of condensation		Object 18 (1 bit)
Window state (open/close)		Objects 13 e 14 (1 bit)
Presence of people in the room		Objects 15 e 16 (1 bit)
Card holder state (badge in/out)		Object 17 (1 bit)

Input variables from internal sensors, physical inputs and standard communication objects.

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

7 Application program for ETS

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

- About EK-E72-TP
- General
- Temperature sensor
- External sensors (from bus)
- LCD Display
- LED
- Temperature control
  - Settings
  - Heating
- Relative humidity control
- Comfort
  - Comfort area
  - Calculated psychrometric values
- Energy saving
  - Windows contacts
  - Presence sensors
  - Card holder
- Logic functions

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

7.1 About EK-E72-TP

The folder ***About EK-E72-TP*** is for information purposes only and does not contain parameters to be set. The information given is:

© Copyright EKINEX S.p.A. 2016
Application software for ETS4
Version 2.00 (or later)
KNX room temperature controller with LCD display 71 series

EKINEX S.p.A.
Via Circonvallazione s/n
I-28010 Miasino (NO) Italy
www.ekinex.com
info@ekinex.com

7.2 General

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

- Device operation as
- Temperature displayed unit
- Default displayed information
- Time to return to default display information
- Button function level
- Time to exit change without saving
- Delay after bus voltage recovery

The folder has no secondary folders.

7.2.1 Parameter table

Parameter name	***Conditions***	***Values***
Device operation as		**stand-alone** stand-alone/chrono slave
	If configured as slave, the room temperature controller receives from a KNX device (acting as supervisor) HVAC modes, setpoint values, etc.	
Temperature displayed unit		**Celsius** Fahrenheit
Default displayed information		**actual temperature** temperature setpoint
	The actual temperature is the value by which the device performs the temperature regulation. It may be the value measured from a single sensor (internal, from the bus or from an input) or the weighted average of the temperatures measured by a main sensor and an additional sensor. *The displayed setpoint temperature is that of the operating mode currently set on the room temperature controller (deduced from the symbol on).*	
Time to return to default display		**5 s** [other values in the range 10 s … 1 min]
	Time interval after which the display automatically switches between the manually recalled information to the default information.	
Button function level		end user **system integrator**
	This parameter allows you to partially disable the functions that can be recalled	

Parameter name	***Conditions***	***Values***
	using the rockers.	
Time to exit change without saving		**8 s** [other values in the range 2 s … 12 s]
	Time interval without further pressing of the rockers at the end of which the device exits the procedure without saving the current changes.	
Delay after bus voltage recovery		**00:00:04.000 hh:mm:ss:fff** [range 00:00:04.000 … 00:10:55.350]
	Time interval after which the transmission of the telegrams on the bus starts after the power supply is restored. The delay affects both the event-driven transmission and the cyclic transmission of a telegram. Regarding the latter, the counting of the pause interval for retransmission starts at the end of the time of initial delay. *The field has format hh:mm:ss:fff (hours : minutes : seconds .milliseconds): the default value 00:00:04.000 corresponds to 4 seconds.*	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Rockers lock		1 Bit	C-W---	[1.002] boolean	73
Thermal generator lock		1 Bit	C-W---	[1.005] alarm	68
Alarm 1 (from bus)		1 Bit	C-W---	[1.005] alarm	69
Alarm 2 (from bus)		1 Bit	C-W---	[1.005] alarm	70
Alarm 3 (from bus)		1 Bit	C-W---	[1.005] alarm	71
Alarm 4 (from bus)		1 Bit	C-W---	[1.005] alarm	72

Information displayed as default

One information between the *actual temperature* and the *temperature setpoint* is displayed preferably by the digits of the display. The device allows you to retrieve and display a series of other information pressing the ●●●● symbol on the upper rocker; after the time set in the parameter "Time to return to default information" without further pressure of ●●●●, the display automatically returns to the default information.

Functional level of the touch buttons

The use of the touch buttons for controlling the room temperature controller can be partially inhibited in the configuration phase through a filter for the access to the several functions. When using the touch buttons a distinction is made between:

- first level functions (= short or long pressing of the touch buttons) for the end user;
- second level functions (= combination of touch buttons); to the first level are added a few functions for a system integrator or an installer.

The enabled functional level is set through a special parameter.

7.2.2 Operating mode management

In EK-E72-TP room thermostat, operating modes and corresponding comfort attenuations can be customized according to the intended use of the building where the device is installed. 3 different operating modes are available; the user can select them through the *Device operation as* parameter:

- stand-alone: the user can manually select the operating mode (comfort, standby, economy and bilding protection) but cannot activate or deactivate from LCD display the automatic chrono program set by the system supevisor (e.g. a Touch&See unit).
- stand-alone/chrono: the user can manually select the operating mode and can ativate or deactivate the chrono program from LCD display. This setting is suitable for residential environments.
- slave: the room thermostat works permanently under chrono program. The end user can manually recall the comfort operating mode for a configurable limited time (*Temperature control* ⇒ *Settings* ⇒ *Duration of comfort extension)*; when that time is up, the forced chrono program operating mode returns active. This setting is suitable for business environments.

7.3 Temperature sensor

The ***Temperature sensor*** folder includes the following parameters:

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

7.3.1 Parameter and communication objects tables

Parameter name	*Conditions*	*Values*
Temperature sensor		**enabled** disabled
	The temperature sensor is enabled as default.	
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 offset	Temperature sensor = enabled	**0°C** [range -5°C … +5°C]
Minimum change of value to send [K]	Temperature sensor = enabled	**0,5** [range 0 …5]
	If the parameter is set to 0 (zero),no value is sent after a change.	
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	Comm. Obj. No.
Temperature value	Temperature sensor = enabled	2 Bytes	CR-T--	[9.001] temperature (°C)	1
Temperature threshold1 - Switch	Temperature sensor = enabled, Threshold 1 = below or above	1 Bit	CR-T--	[1.001] switch	2
Temperature threshold 2- Switch	Temperature sensor = enabled, Threshold 2 = below or above	1 Bit	CR-T--	[1.001] switch	3

Acquisition filter

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

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

Correction of the measured temperature

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

7.4 External sensors (from bus)

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

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

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

7.4.1 Parameter and communication object tables

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

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

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

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Brightness value (from bus)	enabled	2 Byte	C-W---	[9.004] Lux (lux)	4
Room temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature (°C)	5
Humidity (2 bytes, from bus)	Relative humidity sensor = enabled,	2 Byte	C-W---	[9.007] humidity (%)	6

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
	Humidity comm. obj. size = 2 byte				
Humidity (1 byte, from bus)	Relative humidity sensor = enabled, Humidity comm. obj. size = 1 byte	1 Byte	C-W---	[5.001] percentage (0..100%)	7
Antistratification temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature (°C)	8
Outdoor temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature °C	9
Coil temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature (°C)	10
Floor temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature (°C)	11
Flow temperature (from bus)	enabled	2 Byte	C-W---	[9.001] temperature (°C)	12
Anticondensation (from bus)	enabled	1 Bit	C-W---	[1.001] switch	18
Windows contact sensor 1 (from bus)	enabled	1 Bit	C-W---	[1.019] window/door	13
Windows contact sensor 2 (from bus)	enabled	1 Bit	C-W---	[1.019] window/door	14
Presence sensor 1 (from bus)	enabled	1 Bit	C-W---	[1.018] occupancy	15
Presence sensor 2 (from bus)	enabled	1 Bit	C-W---	[1.018] occupancy	16
Contact of card holder (from bus)	enabled	1 Bit	C-W---	[1.001] switch	17

About sensor timeout

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

7.5 Weighted temperature value

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

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

7.5.1 Parameter and communication object tables

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

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Weighted temperature	Cyclic sending interval ≠ no sending	2 Byte	CR-T--	[9.001] temperature °C	19

About weighted temperature

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

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

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

7.6 LCD display

The folder ***LCD display*** includes the following parameters:

- Backlight intensity
- Automatic backlight dimming
- Visualisation type
- Time before energy saving mode
- Backlight when in energy saving mode
- Behaviour on button press
- Perceived temperature
- Temperature setpoint
- Relative humidity
- Relative humidity setpoint
- Outdoor temperature

Energy saving mode

After a configurable time interval, the room temperature controller switches from normal to energy saving operation. In this display mode:

- the backlight intensity may be reduced;
- the information content to be displayed may be reduced da visualizzare può essere ridotto (two options: partial and temperature only).

Backlight

The default backlight of the display can be configured according to the installation location and light conditions of the room.

Information to be displayed

The actual temperature is always displayed; in addition, and depending on individual preferences, other information can be displayed in sequence: temperature setpoint (for current operating mode), perceived temperature, relative humidity, relative humidity setpoint and air quality.

7.6.1 Parameters

Parameter name	***Conditions***	***Values***
Backlight intensity		10% / 20% / 30% / 40% / **50%** / 60% / 70% / 80% / 90% / 100%
Automatic backlight dimming	External sensors (from bus) ⇒ Brightness sensors = enabled	**disabled** / enabled
Energy saving		**disabled** / enabled
	If the parameter Energy saving = enabled, after a certain time interval the device automatically reduces the backlight intensity and possibly the information content displayed.	
Visualisation type	Energy saving = enabled	**full** temperature only
	In addition to the digits, “temperature only” includes the symbol (°C or °F).	

Parameter name	***Conditions***	***Values***
Time before energy saving mode	Energy saving = enabled	**10 s** / 15 s / 30 s 45 s / 1 min
Backlight when in energy saving mode	Energy saving = enabled	off / 2% / 5% / 10% / 15% / 20% / **25%** / 30%
Behaviour on button press	Energy saving = enabled	**backlight only** backlight and button function
	It defines the reaction at the first press of a rocker when the device is in energy saving mode.	
Information to be displayed		
Actual temperature	Temperature sensor = enabled and/or External sensors (from bus) ⇒ room temperature = enabled	**always active**
Temperature setpoint		**enabled** / disabled
Relative humidity	Relative humidity sensor enabled (external from bus)	**enabled** / disabled
Relative humidity setpoint	Relative humidity sensor enabled (external from bus)	**enabled** / disabled
Outdoor temperature	Outdoor temperature sensor (from bus) is enabled	**enabled** / disabled

7.7 Leds intensity

The capacitive touch buttons used to interact with the thermostat functions are arranged in 4 areas corresponding to the LCD angles. Each touch button has its own backlight led to make the identification of each associated function easier. It is possible to select 3 different intensity levels for leds backlight and it is also possible to switch to a lower (or off) level when no interaction with the display is needed.

The ***Leds intensity*** folder includes the following parameters:

- Technical alarm
- Standby leds intensity
- Leds intensity when buttons are touched

7.7.1 Parameter and communication object tables

Parameter name	*Conditions*	*Values*
Leds intensity from bus		**no** / yes
Leds intensity	Leds intensity from bus = no	0 / 1 / 2 / **3**
Leds intensity at standby	LCD display ⇒ energy saving = enabled	**no change** / 0 / 1 / 2 / 3
	This parameter defines the standby minimum backlight of the display areas where the 4 touch buttons are placed, when no interactions happen between user and room thermostat. Backlight attenuation function is active only if energy saving function is enabled in "LCD display" folder.	
Technical alarm		**disabled** / enabled
	It enables the communication object nr. 0 "Technical alarm" that allows to activate an alarm signal via a bus telegram. The flashing led indicates that the alarm condition is active.	

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Technical alarm	Technical alarm = enabled	1 Bit	C--W-	[1.005] alarm	0
Leds intensity percentage		1 Byte	C--W-	[5.001] percentage (0..100%)	67

7.8 Temperature control

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

- Settings
- Heating
- Cooling
- Ventilation
- Scenes

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

7.8.1 Settings

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

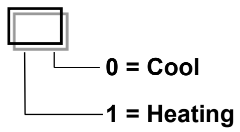
- Thermostat function
- Command Communication Object
- Heating – cooling switchover
- Setpoint Cyclic sending interval
- Max manual temperature change
- Saving timeout (manual change)
- End of manual operation
- Max setpoint temperature change
- Scenes
- Valve protection function
- Frequency
- Time interval

7.8.1.1 Parameter and communication object tables

Parameter name	***Conditions***	***Values***
Thermostat function		**heating** cooling both heating and cooling
Command Communication Object	Thermostat function = both heating and cooling	**separated** / unique
Heating–cooling switch over	Thermostat function = both heating and cooling	manual **from bus** automatic
Heating-cooling cyclic sending interval	Thermostat function = both heating and cooling	**no sending** [other values in the range 30 s … 120 min]

Parameter name	Conditions	Values
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 one, depending on the operating mode set manually by the user or automatically by another KNX supervising device with the possibility of time scheduling. The actual setpoint value takes also into account the actual state of the contacts window and presence detection (if the corresponding functions are enabled).	
Max manual temperature change		not allowed, ± 1°C, ± 2°C, **± 3°C**, ± 4°C, ± 5°C, ± 6°C, ± 7°C, ± 8°C, ± 9°C, ± 10°C
	It defines the maximum range allowed for the manual change of the temperature value.	
End of manual operation	General ⇒ Device operation as = stand-alone	**till first telegram from bus** [other values in the range 30 min … 48 h]
Exit manual mode on setpoint from bus		**no** / si
	It defines the exit from manual/forced mode in case of setpoint modification on bus (communication objects index from 29 to 36)	
Max setpoint temperature change		not allowed, ± 1°C, ± 2°C, ± 3°C, ± 4°C, ± 5°C, ± 6°C, ± 7°C, ± 8°C, **± 9°C**, ± 10°C
	It defines the maximum time allowed for changing the values of temperature setpoint in the several operating modes.	
Duration of comfort extension	General ⇒ Device operation as = slave	**not allowed**, [other values in the range 15 min … 4 h]
	When device operation as = slave, if the operating mode forced by the time scheduling is not comfort or building protection, this parameter defines the maximum duration of temporary comfort before returning to the programmed operating mode.	
Scenes		**disabled** / enabled
Transmission delay after mode change		
Valve protection function		**disabled** / enabled
	It enables the function that activates the drive for the valve control during periods of inactivity of the system.	
Frequency	Valve protection function = enabled	once a day **once a week** once a month
Time interval	Valve protection function = enabled	**10 s** [other values in the range 5 s … 20 min]

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
Actual setpoint		2 Byte	CR-T--	[9.001] temperature (°C)	27
Manual setpoint		2 Byte	C-W---	[9.001] temperature (°C)	28

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Heating/cooling status out	Always visible	1 Bit	CR-T--	[1.100] heating/cooling	20
	The communication object is updated on the bus on event of change internally elaborated by the controller. The object is always exposed and contains the information about the current conduction mode of the internal temperature controller. **[1.100] DPT Heat/Cool 1 Bit** 				
Heating/cooling status in	Thermostat function = both heating and cooling; Heating – cooling switchover = from bus	1 Bit	C-W---	[1.100] heating/cooling	21
	The communication object is received by the bus. On switching event, internal controllers of primary and auxiliary stage (if enabled) switch their operating mode. The actual operating mode is displayed by the corresponding icon.				
HVAC mode in		1 Byte	C-W---	[20.102] HVAC mode	22
	The device receives the operating mode (HVAC mode) from a bus device with function of supervisor. The operating mode received through this communication object can be later modified by the user (in this case the room thermostat switches to manual mode).				
HVAC forced mode in		1 Byte	C-W---	[20.102] HVAC mode	23
	The communication object allows to receive the operating mode same way as "HVAC mode in" communication object, except the operating mode received through this objct (apart from AUTO command) can no longer be modified by user. User can modify the operating mode only after "HVAC forced mode in" has sent AUTO command.				
HVAC mode out		1 Byte	CR-T--	[20.102] HVAC mode	24
HVAC manual mode		1 Byte	C-WTU-	[20.102] HVAC mode	25
Chrono active status		1 Bit	CR-T--	[1.011] state	26
Manual/forced setpoint active status		1 Bit	CRWTU-	[1.011] state	50
Building protection HVAC mode active		1 Bit	CR-T--	[1.011] state	74

About heating/cooling terminals

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

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

- radiant panels + dehumidification units.

7.8.1.2 Heating/cooling switchover

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

1) manually on the device by the end user;
2) automatically by the device;
3) from the KNX bus through a dedicated communication object.

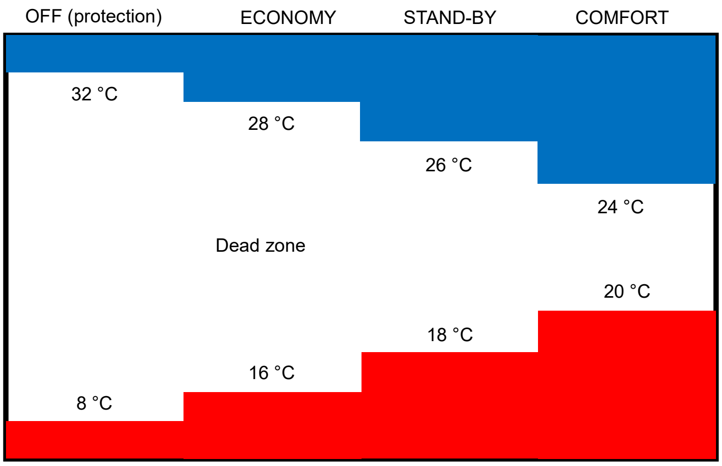
Manual switch-over (mode 1)

The manual switch-over is suitable for bus systems with one or a limited number of room temperature controllers. If the devices have been configured for this purpose, the user does the switch-over manually on the device (that acts as a "master" for the switch-over function); the device sends on the bus the output communication object [DPT 1.100 heat/cool] that switches possibly other room temperature controllers ("slave" devices) connected through a dedicated group address.

Automatic switch-over (mode 2)

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

The automatic switch-over is realised with the introduction of a neutral zone according to the scheme in the picture below.



Neutral zone and example of setpoint values correctly distributed

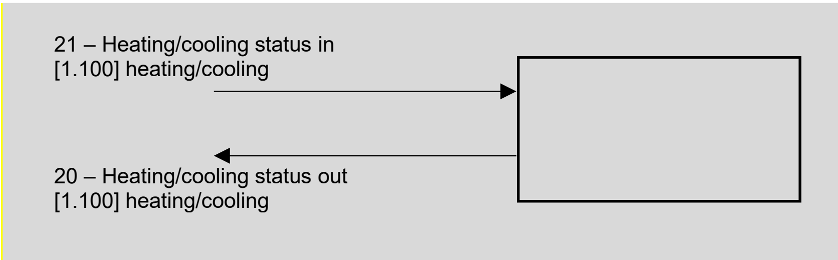
Until the actual (measured) temperature is located below the setpoint value for the heating, the operation is heating; in the same way, if the actual value (measured) is greater than the setpoint value for the cooling, the mode is cooling. If the actual value (measured) temperature is within the dead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

Switch-over via KNX bus (mode 3)

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

The communication objects indicated in the block diagram allows monitoring and modifying the current conduction mode forced on the temperature controller. The object 20 – *Heating/cooling status out* is always exposed, even when the thermostat function is set on heating or cooling only. When the function is set on both heating and cooling, the cyclic sending on bus can be enabled; anyway, the information about the actual conduction mode can be acquired with a reading request to this commiunication object.

The object 21 – *Heating/cooling status in* is exposed only when the function is both heating and cooling and the switching among the different modes is performed by the bus.

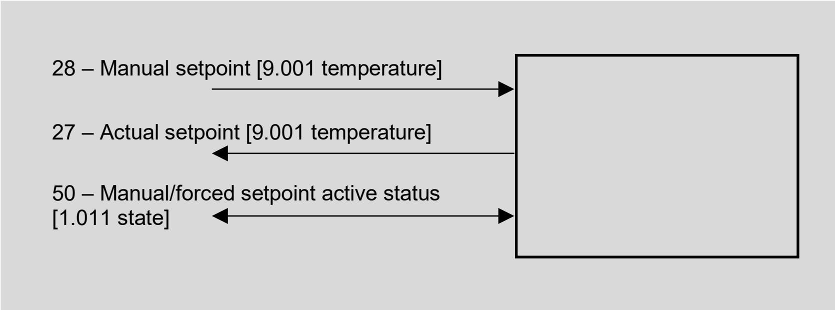


7.8.1.3 Valve protection function

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

7.8.1.4 Remote Setpoint modification

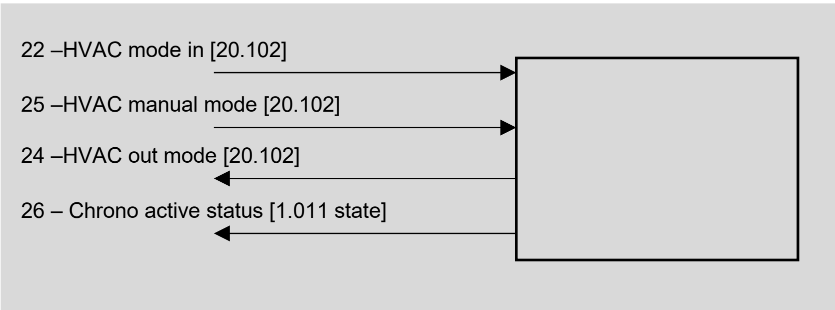
The communication objects shown in figure allow to monitor the Setpoint forced modifications performed locally by the user when interacting with the LCD display and the touch buttons of the room thermostat. The communication objects (from now on: C.O.) also allow to perform the same modifications remotely,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



Those objects are about the Setpoint forced modification (symbol M on the LCD display): alternatively, the supervisor can act directly on the operating mode setpoints (C.O. with index 29-36). The value of the C.O. *27 - Actual setpoint* represents the current operative setpoint which the control algorithms are based on. The C.O. *50 – Manual/forced setpoint active status* indicates (read request mode) if the forced mode is active (symbol M on the LCD display present). The supervisor can force at any time the actual setpoint by writing a new value directly into the C.O. *28 – Manual setpoint*. The C.O. *50 – Manual/forced setpoint active status* can also be used in writing to exit the active forced mode.

7.8.1.5 Remote operative mode modification

The communication objects shown in figure allow to monitor the operating mode (comfort, standy, economy and building protection) modifications performed locally by the user when interacting with the LCD display and the touch buttons of the room thermostat, or the operating mode forced by chrono program. The communication objects (from now on: C.O.) also allow to perform the same modifications remotely, for example from a supervisor software.



The C.O. *22 – HVAC mode in* is associated to the chrono program. The C.O.s *24 – HVAC mode out* and *26 – HVAC chrono active status* allow the remote supervisor to discern the operating mode currently active on the room thermostat and also allow to understand if the chrono program is active or if attenuation is handled manually or not. The supervisor can set at any time a manual operating mode through C.O. *25 – HVAC manual mode*; to start the chrono program remotely, the C.O. *25 – HVAC manual mode* is to be set on value 0 = Automatic.

7.8.2 Heating

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

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

7.8.2.1 Parameter and communication object tables

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

Parameter name	*Conditions*	*Values*
Comfort temp. setpoint [°C]		21 [range 10 … 50]
Standby temp. setpoint [°C]		**18** [range 10 … 50]
	For a correct operation of the device the standby temperature setpoint has to be < comfort temperature setpoint.	
Economy temp. setpoint [°C]		**16** [range 10 … 50]
	For a correct operation of the device the economy temperature setpoint has to be < standby temperature setpoint.	
Building protection temp. setpoint [°C]		**7** [range 2 … 10]

Parameter name	Conditions	Values
Heating type		**radiators** electric fan-coils floor radiant panels ceiling radiant panels
	It defines the terminal used for the thermal exchange in the room. The choice affects the parameters of the PWM control algorithm (Proportional band and Integral time) and the control options.	
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]
Hysteresis position	Heating type = floor radiant panels, ceiling radiant panels, Control type = 2 point hysteresis	**below** / above
	The above hysteresis is suitable in case of special applications requiring mixing group control.	
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	**15 min** [range 5 … 240 min]
Proportional band [0,1 K]	Control type = continuous or PWM	* [range 0 … 255]
	The value is in tenths of Kelvin (K) degree. **) The field contains a preset value that depend on the selected heating type (the value can be modified):* • *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 parameter Proportional band represents the max difference between the setpoint temperature and the measured temperature that causes the max 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 depend on the selected heating type (the value can be modified):* • *radiators: 150 min* • *electric: 100 min* • *fan-coils: 90 min* • *floor radiant panels: 240 min* • *ceiling radiant panels: 180 min*	
Min control value [%]	Control type = continuous or PWM	**15** [range 0 … 30]

Parameter name	Conditions	Values
Max control value [%]	Control type = continuous or PWM	**85** [range 70 … 100]
Floor temperature limitation	Heating type = floor radiant panels, External sensors ⇒ Floor surface temperature sensor = enabled	**disabled** / enabled
	This parameter enables the floor temperature limitation of a floor radiant panel. It is mandatory to measure thefloor surface temperature by enabling the corresponding temperature sensor in "External sensors (from bus)" folder. ***Important!*** *This function does not replace the overtemperature protection usually installed in hydronic floor systems, realized with the proper safety thermostat.*	
Temperature limit [°C]	Floor temperature limitation = enabled	**29** [range 20 … 40]
	According to EN 1264 a maximum allowed temperature is prescribed for the surface of a floor heating system: • *T(sup) max ≤ 29°C per le zone di normale occupazione;* • *T(sup) max ≤ 35°C per le zone periferiche degli ambienti.* *National standard may limit those temperatures to lower values. Per zone periferiche si intendono fasce situate generalmente lungo i muri dell'ambiente rivolti verso l'esterno dell'edificio con larghezza massima di 1 m.*	
Hysteresis [K]	Floor temperature limitation = enabled	**0,3 K** [other values in the range 0,2 K … 3 K]
	Before quitting from the alarm status, the device waits until the surface temperature decreases under the threshold set offset pari al valore di isteresi.	
Auxiliary heating		**disabled** / enabled
Communication object	Auxiliary heating = enabled	**separated** unique
Disabled from bus	Auxiliary heating = enabled	**no** / yes
	It enables the activation and deactivation of the function through a telegram sent on the bus by a supervising device.	
Offset from setpoint	Auxiliary heating = enabled	**0,6 K** [other values in the range 0 …3 K]
Hysteresis [K]	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]
Ventilation for auxiliary heating	Heating type = floor radiant panels or ceiling radiant panels	**disabled** / enabled
	This option allows matching a system with high inertia as the floor radiant panels (hydronic version) to a system with low inertia as the fan-coils.	

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
Comfort setpoint (heating)		2 Byte	CRWTU-	[9.001] temperature (°C)	29
Standby setpoint (heating)		2 Byte	CRWTU-	[9.001] temperature (°C)	31

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Economy setpoint (heating)		2 Byte	CRWTU-	[9.001] temperature (°C)	33
Building protection setpoint (heating)		2 Byte	CRWTU-	[9.001] temperature (°C)	35
Heating out command	Control type = 2 points hysteresis or PWM, Command communication object = separated	1 Bit	CR-T--	[1.001] switch	38
Heating out command	Control type = continuous, Command communication object = separated	1 Byte	CR-T--	[5.001] percentage (0..100%)	38
Heating and cooling out command	Tipo Control type = 2 points hysteresis or PWM, Command communication object = unique	1 Bit	CR-T--	[1.001] switch	38
Heating and cooling out command	Control type = continuous, Command communication object = unique	1 Byte	CR-T--	[5.001] percentage (0..100%)	38
Auxiliary heating out command	Auxiliary heating = enabled, Command communication object = separated	1 Bit	CR-T--	[1.001] switch	40
Auxiliary heating and cooling output command	Auxiliary heating = enabled, Command communication object = unique	1 Bit	CR-T--	[1.001] switch	40
Auxiliary heating disable	Auxiliary heating = enabled, Disabled from bus = yes	1 Bit	C-W---	[1.003] enable	42
Temperature setpoint change lock		1 Bit	C-W---	[1.003] enable	37

About floor temperature limitation function

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

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

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

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

The surface temperature limitation may be realized for several purposes:

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

7.8.3 Cooling

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

- Comfort temp. setpoint [°C]
- Standby temperature setpoint [°C]
- Economy temp. setpoint [°C]
- Building protection temp. setpoint [°C]
- Cooling type
- Control type
- Hysteresis
- Cyclic sending interval
- Min. change of value to send [%]
- PWM cycle time
- Proportional band [0,1 K]
- Integral time [min]
- Anticondensation with probe
- Anticondensation protection type 2
- Auxiliary cooling
- Disabled from bus
- Offset from setpoint
- Hysteresis ON/OFF [K]

7.8.3.1 Parameter and communication object tables

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

Parameter name	***Conditions***	***Values***
Comfort temp. setpoint [°C]		**23** [range 10 … 50]
Standby temp. setpoint [°C]		**26** [range 10 … 50]
	For a correct operation of the device the standby temperature setpoint has to be > comfort temperature setpoint.	
Economy temp. setpoint [°C]		**28** [range 10 … 50]
	For a correct operation of the device the standby temperature setpoint has to be > economy temperature setpoint.	
Building protection temp. setpoint [°C]		**36** [range 30 … 50]
Cooling type		fan-coils floor radiant panels ceiling radiant panels
	If in Settings the parameter Thermostat function = both heating and cooling and Command communication object = unique, the parameter Cooling type is bound to the choice done for Heating.	
Control type	Command communication object = separated	**2 point hysteresis** PWM (pulse width modulation) continuous
	If in Settings the parameter Thermostat function = both heating and cooling and Command communication object = unique, the parameter Control type is bound to the choice done for Heating.	

Parameter name	***Conditions***	***Values***
Hysteresis	Control type = 2 point hysteresis	**0,3 K** [other values in the range 0,2 K … 3 K]
Hysteresis position	Heating type = floor radiant panels, ceiling radiant panels, Control type = 2 point hysteresis	**below** / above
	The above hysteresis is suitable in case of special applications requiring mixing group control.	
Cyclic sending interval	Control type = 2 point hysteresis or 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 (pulsa width modulation)	**15 min** [range 5 … 240 min]
Proportional band [0,1 K]	Control type = continuous or PWM	***** [range 0 … 255]
	The value is in tenths of Kelvin (K) degree. **) The field contains a preset value that depend on the selected cooling type (the value can be modified):* • *fan-coils: 40 (4 K)* • *floor radiant panels: 50 (5 K)* • *ceiling radiant panels: 50 (5 K)* *The value of the parameter Proportional band represents the max difference between the setpoint temperature and the measured temperature that causes the max control output.*	
Integral time [min]	Control type = continuous or PWM	***** [range 0 … 255 min]
	**) The field contains a preset value that depend on the selected cooling type (the value can be modified):* • *fan-coils: 90 min* • *floor radiant panels: 240 min* • *ceiling radiant panels: 180 min*	
Min control value [%]	Control type = continuous or PWM	**15** [range 0 … 30]
Max control value [%]	Control type = continuous or PWM	**85** [range 70 … 100]
Anticondensation with probe	Cooling type = floor radiant panels or ceiling radiant panels, External sensors (from bus) ⇒ Anticondensation = enabled	**disabled** / enabled

Parameter name	***Conditions***	***Values***
Active anticondensation	Cooling type = floor radiant panels or ceiling radiant panels, External sensors (from bus) ⇒ Flow temperature sensor = enabled	**disabled** enabled (project temperature)
	Cooling type = floor radiant panels or ceiling radiant panels, External sensors (from bus) ⇒ Flow temperature sensor = enabled	**disabled** enabled (comparison between flow temperature and dew-point)
	If flow temperature is lower than calculated dew point, the operating mode is cooling and the room thermostat is in flow request, then the thermostat will close the valve and display an alarm condition.	
Flow temperature (project)	Cooling type = floor radiant panels or ceiling radiant panels, External sensors (from bus) ⇒ Flow temperature sensor = disabled	**14°C** [other values in the range 14,5°C … 20°C]
	Only displayed if the flow temperature from external sensor (from bus) is not available.	
Hysteresis [K]	Anticondensation active = enaled	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 quitting the alarm condition you must wait for the calculated dew temperature to e greater than the flow temperature value by an offset equal to the hysteresis value.	
Auxiliary cooling		**disabled** / enabled
Disabled from bus	Auxiliary cooling = enabled	**no** / yes
	This parameter enables the activation and deactivation of the function through a telegram from a bus device with supervising function.	
Offset from setpoint	Auxiliary cooling = enabled	0,2 K / **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 ON/OFF [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	hh:mm:ss (**00:00:00**)
	00:00:00 means that the cyclic sending is not enabled.	
Ventilation for auxiliary cooling	Cooling type = floor radiant panels or ceiling radiant panels	**disabled** / enabled
	This option allows combining a high-inertial system as the floor radiant panels to a low-inertial one as the fan-coils.	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Comfort setpoint (cooling)		2 Byte	CRWTU-	[9.001] temperature (°C)	30
Standby setpoint (cooling)		2 Byte	CRWTU-	[9.001] temperature (°C)	32
Economy setpoint (cooling)		2 Byte	CRWTU-	[9.001] temperature (°C)	34
Building protection setpoint (cooling)		2 Byte	CRWTU-	[9.001] temperature (°C)	36
Cooling out command	Control type = 2 point hysteresis or PWM	1 Bit	CR-T--	[1.001] switch	39

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Cooling out command	Control type = continuous	1 Byte	CR-T--	[5.001] percentage (0..100%)	39
Auxiliary cooling output command	Auxiliary cooling = enabled	1 Bit	CR-T--	[1.001] switch	41
Auxiliary cooling enable	Auxiliary cooling = enabled, Disabled from bus = yes	1 Bit	C-W---	[1.003] enable	43
Anticondensation alarm	At least one anticondensation protection enabled	1 Bit	CR-T--	[1.005] alarm	66

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

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

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

Nr.	Type	Denomination	Description
1a	Passive	Anticondensation protection by probe (via bus)	The thermostat receives the information about condensation via bus from a different KNX device through communication object 27: Anticondensation (from bus) [DPT 1.001 switch].
2a	Active	Anticondensation protection with comparison between flow temperature (constant projected value, set as parameter on ETS and dew-point temperature (calculated by the thermostat)	Software protection that intervenes by closing down the room cooling circuit when the flow temperature defined in the hydronic project (as set in the corresponding ETS parameter) is lower than dew-point temperature calculated by the room thermostat using temperature and relative humidity values. The communication object involved is 45: Cooling out command [DPT 1.001 switch].
2b	Active	Anticondensation protection with comparison between flow temperature (constant projected value, set as parameter on ETS and dew-point temperature (calculated by the thermostat)	Software protection that intervenes by closing down the room cooling circuit when the actual measured flow temperature and received via bus from a different KNX device is lower than dew-point temperature calculated by the room thermostat using temperature and relative humidity values. The communication objects involved are 21 at input: Flow temperature (from bus) [DPT 9.001 temperature °C] and 45: Cooling out command [DPT 1.001 switch].

3	Active	Anticondensation protection with dew-point temperature sending over the bus and adjustment of the flow temperature	Software protection that foresees the sending on the bus of the dew-point temperature calculated by the room thermostat using temperature and relative humidity values to a KNX device capable of controlling the mixing condition of the conveying fluid for the cooling circuit. The regulation is performed by the KNX device receiving the dew-point temperature sent by the thermostat. The communication object involved is 59: Dew-point temperature [DPT 9.001 temperature °C].

Anticondensation protection modes

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

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

- if the flow temperature value is not available (case 2a of the table), you can insert the value used in the project (parameter Flow temperature (projected));
- if the flow temperature value is available (case 2b of the table), you enable the Anticondensation Active parameter for comparison;
- if an bus actuator capable of intervention on the conveying fluid’s mixing is available, the thermostat sends on the bus the calculated value of the dew-point temperature; the actuator compares this value with the flow temperature and, if necessary, modifies the mixing conditions in order to prevent the risk for condensation formation.

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

7.8.4 Main and auxiliary ventilation

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

- Ventilation function
- Control type
- Threshold first speed [0,1 K]
- Threshold second speed [0,1 K]
- Threshold third speed [0,1 K]
- Speed control hysteresis [K]
- Proportional band [0,1 K]
- Minimum change of value to send [%]
- Hot start
- Min. temp.to start ventilation [°C]
- Disable ventilation from bus
- Signal from bus
- Fan start delay
- Fan stop delay

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

Heating ⇒ Type of heating = fan-coils or Type of cooling = fan-coils

or a combination of the two conditions:

Heating ⇒ Type of heating = floor radiant panels or ceiling radiant panels and *Heating* ⇒ Ventilation ⇒ Auxiliary heating = enabled

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

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

7.8.4.1 Parameter and communication object tables

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

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

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

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
Fan continuous speed	Control type = continuous regulation	1 Byte	CR-T--	[5.001] percentage (0..100%)	44
Fan speed 1	Control type = 1, 2 o 3 speeds	1 Bit	CR-T--	[1.001] switch	45
Fan speed 2	Control type = 2 or 3 speeds	1 Bit	CR-T--	[1.001] switch	46
Fan speed 3	Control type = 3 speeds	1 Bit	CR-T--	[1.001] switch	47
Fan control disable	Disable ventilation from bus = yes	1 Bit	C-W---	[1.002] boolean	48
Fan manual speed		1 Byte	CRWTU-	[5.010] counter pulses (0…255)	51
Fan speed status		1 Byte	CR-T--	[5.010] counter pulses (0…255)	52
Fan manual active status		1 Bit	CRWTU-	[1.011] state	53
Fan manual speed percentage		1 Byte	CR-T--	[5.001] percentage	75
Fan manual speed off status		1 Bit	CR-T--	[1.011] state	76

7.8.4.2 Delayed fan start ("hot-start")

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

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

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

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

7.8.4.3 Antistratification function

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

The antistratification function requires:

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

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

7.8.4.4 2-stage configuration with fan-coils as auxiliary stage

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

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

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

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

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

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

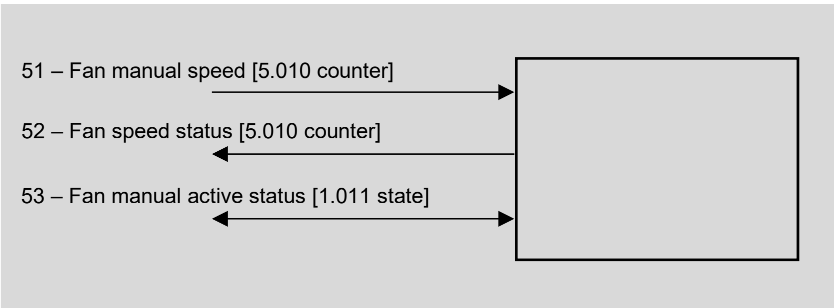
1. Settings ⇒ Thermostat function = both heating and cooling. This configuration enables both folders (heating and cooling)
2. Heating ⇒ Heating type = floor radiant panels or ceiling radiant panels
3. Heating ⇒ Command communication object = separated (if unique is choosen, the parameter Cooling ⇒ Cooling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

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

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

7.8.4.5 *Remote fan speed modification*

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



The C.O. *52 – Fan manual status* allows to evaluate the actual fan speed; the C.O. *53 – Fan manual active status* contains the information about automatic (=0, not active) or manual (=1, active) operating mode. By modifying the C.O. *51 – Fan manual speed*, the fan automatically switches to the setpoint speed; to return to automatic mode (A), the supervisor must exit from manual mode by modifying the C.O. *53 – Fan manual active status* (=0, not active).

Accepted values for C.O.s 51 and 52 depend on the number of speeds set in ETS.

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

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

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

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

7.8.5 Scenes

The folder allows the scenes configuration (up to 8), assigning to each one an identification number and the operating mode to be activated when recalled (e.g. with an ekinex pushbutton or another KNX device with this function). If *Learning mode = enabled*, receiving a telegram of scene storage determines the association of the scene to the operating mode currently set on the Touch&See unit.

Important! Be careful setting the *Download overwrite* parameter. The download of the application program, particularly after the first commissioning of the system, may cause the loss of the already stored scenes.

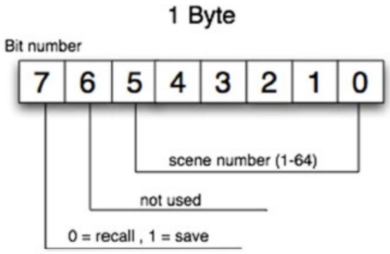
The ***Scenes*** folder includes the following parameters:

- Download overwrite
- Scene X
- Scene number
- HVAC mode
- Activation delay
- Learning mode

Condition: *Temperature control* ⇒ Settings ⇒ Scenes = enabled.

7.8.5.1 Parameter and communication object tables

Parameter name	***Conditions***	***Values***
Download overwrite		**disabled** / enabled
	If Overwrite download = disabled: at the download of the application on the device, the operating modes previously stored are not overwritten. *If Overwrite download = enabled: at the download of the application on the device, the operating modes previously stored are reprogrammed with the values selected from the HVAC mode parameter.*	
Scene X		**disabled** / enabled
	This parameter enables the scene X (X = 1, 2, … 8).	
Scene number	Scene X = enabled	**1** [range 1 … 64]
HVAC mode	Scene X = enabled	auto / **comfort**/ standby / economy / building protection
	This parameter defines the operating mode of the scene X.	
Activation delay	Scene X = enabled	hh:mm:ss (**00:00:00**)
	Receiving a telegram that recalls a scene, once elapsed the time interval set in the Activation delay parameter, the programmed operating mode is activated.	
Learning mode	Scene X = enabled	**disabled** / enabled

Nome oggetto	Condizioni	Dim.	Flags	DPT	N° Ogg. Com.
HVAC scene number		1 Byte	C-W---	[17.001] scene number [18.001] scene control	54
	It stores or recalls a scenario. The six least significant bits (0 to 5) in the byte of the code represent the number of the scene, while the most significant bit (7) is the operation code (1 = stores, 0 = recalls). 				

If the room thermostat is configured as slave (*General* folder ⇒ *Device operation as* = slave) all scenes sento to the device have no effect: the device is therefore configured only to answer to the chrono program it is enslaved to.

If the room thermostat is configured as stand-alone, it is not possible to activate a scene that sets the device to automatic mode (*HVAC mode* = auto): all other HVAC modes are available to be activated by a scene.

If the room thermostat is configured as stand-alone/chrono, it is possible to activate scene that recall all HVAC modes, including Automatic mode (*ModoHVAC* = auto): the latter will enslave the room thermostat to the configured chrono program.

7.9 Relative humidity control

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

- Dehumidification
- Humidification

The secondary folders ***Dehumidification*** and ***Humidification*** appear if at a humidity sensor is enabled.
The acquisition of relative humidity is made by bus from a KNX R.H. sensor.

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

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

7.9.1 Dehumidification

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

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

7.9.1.1 Parameter and communication object tables

Parameter name	***Conditions***	***Values***
Dehumidification function		**disabled** cooling heating both cooling and heating
	Parameter that selects the dehumidification function.	
Humidity setpoint [%]	Dehumidification function ≠ disabled	**55** [range 30 … 60]
Hysteresis	Dehumidification function ≠ disabled	**0,8 %** [other values in the range 0,5 … 4%]

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

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Relative humidity setpoint for dehumidification		2 Byte	CRWTU-	[9.007] humidity (%)	58
Dehumidification command		1 Bit	CR-T--	[1.001] switch	60
Dehumidification water battery command	Temperature control ⇒ Settings ⇒ Thermostat function = both heating and cooling, Temperature control ⇒ cooling ⇒ cooling type = floor radiant panels or ceiling radiant panels, Relative humidity ⇒ dehumidification ⇒ dehumidification function = cooling	1 Bit	CR-T--	[1.001] switch	61
Dehumidification integration control	Temperature control ⇒ Settings	1 Bit	CR-T--	[1.001] switch	62

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
	⇒ Thermostat function = both heating and cooling, Temperature control ⇒ cooling ⇒ cooling type = floor radiant panels or ceiling radiant panels, Relative humidity ⇒ dehumidification ⇒ dehumidification function = cooling				
	This object switches ON if (simultaneously) the relative humidity is greater than the relative humidity setpoint and the room temperature is greater than the setpoint of the parameter Temperature difference for integration.				
Dehumidification control disable		1 Bit	C-W---	[1.002] boolean	63

7.9.2 Humidification

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

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

7.9.2.1 Parameter and communication object tables

Parameter name	Conditions	Values
Humidification function		**disabled** cooling heating both cooling and heating
	Parameter that selects the humidification function.	
Humidity setpoint	Humidification ≠ disabled	**35** [range 25 … 45 %]
Humidity hysteresis [%]		**0,8 %** [other values in the range 0,5 … 4%]
Cyclic sending interval		**no sending** [other values in the range 30 s … 120 min]
Disable humidification control from bus		**no** / yes
Signal from bus	Disable humidification control from bus = yes	**not inverted** / inverted

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
Relative humidity setpoint for humidification		2 Byte	CRWTU-	[9.007] humidity (%)	59
Humidification command		1 Bit	CR-T--	[1.001] switch	64
Humidification control disable	Disable humidification control from bus = yes	1 Bit	C-W---	[1.002] boolean	65

7.10 Comfort

The ***Comfort*** folder includes the following secondary folders:

- Comfort area
- Calculated psychrometric values

The secondary folders **Comfort area** and **Calculated psychrometric values** appear if the relative humidity sensor is enabled.

7.10.1 Comfort area

The secondary folder ***Comfort area*** includes the following parameters:

- Cyclic sending interval
- Minimum temperature [°C]
- Maximum temperature [°C]
- Minimum relative humidity [%]
- Maximum relative humidity [%]
- Maximum absolute relative humidity [g/kg x 0,1]

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

7.10.1.1 Parameter and communication object tables

Parameter name	***Conditions***	***Values***
Cyclic sending interval		**no sending** [other values in the range 30 s … 120 min]
Minimum temperature [°C]		**20** [range 0 … 50]
Maximum temperature [°C]		**26** [range 0 … 50]
Minimum relative humidity [%]		**30** [range 0 … 100]
Maximum relative humidity [%]		**65** [range 0 … 100]
Maximum absolute humidity [g/kg x 0,1]		**115** [range 50… 200]

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Comfort state		1 Bit	CR-T--	[1.006] binary value	55
	Comfort state = 1: temperature and relative humidity conditions are inside the defined climatic comfort area. *Comfort state = 0: temperature and relative humidity conditions are outside the defined climatic*				

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
	comfort area.				

Note about comfort area

It is possible to verify if the measured temperature and relative humidity values are inside or ouside a comfort area defined by the corresponding parameters, and then send the relative signal on the bus. The comfort area can be defined:

- by DIN 1946, keeping the ETS default values for T(min), T(max), R.H.(min) and R.H.(max) unchanged;
- customizing the parameters within the range allowed by the application program, based on building intended use, activity and other specific factors.

Usually, the following values are taken as comfort area default:

- Standard max temperature 26°C;
- Standard min temperature 20°C;
- Standard max relative humidity 65°C;
- Standard min relative humidity 30°C;

These values are valid for both heating and cooling modes.

7.10.2 Calculated psychrometric values

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

- Dew-point temperature [°C]
- Cyclic sending interval
- Min. change of value to send [K]
- Temperature to send without request [°C]
- Perceived temperature [°C]

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

7.10.2.1 Parameter and communication object tables

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

Parameter name	*Conditions*	*Values*
Perceived temperature [°C]		**disabled** / enabled
	Calculation of this value is based on Humidex index. The correlation is significative for temperature values between 20 and 55°C.	
Cyclic sending interval	Perceived temperature = enabled	**no sending** [other values in the range 30 s … 120 min]
Min. change of value to send [K]	Perceived temperature = enabled, Cyclic sending interval ≠ no sending	**0,2 K** / no sending [other values in the range 0,2 … 3 K]

Object name	*Conditions*	*Dim.*	*Flags*	*DPT*	*Comm. Obj. No.*
Dew-point temperature	Dew-point temperature = enabled	2 Byte	CR-T--	[9.001] temperature °C	56
Perceived temperature	Perceived temperature = enabled	2 Byte	CR-T--	[9.001] temperature °C	57

Note about perceived temperature

Measuring both relative humidity and room temperature allows to calculate the perceived temperature, which represents an index of the condition of climatic discomfort during the summer season. The calculated value ca be displayed on the thermostat (if enabled) and/or sent on the KNX bus o be displayed by other bus devices (for example, a Touch&See unit). The perceived temperature is calculated using Humidex index.

7.11 Energy saving

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

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

- Window contacts
- Presence sensors
- Card holder

7.11.1 Window contacts

The ***Window contacts*** secondary folder appears if at least a sensor dedicated to this function is enabled i.e. if the following condition is verified: External sensors (from bus) ⇒ Windows contact sensor 1 or 2 (from bus) = enabled

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

- Window contacts function
- Wait time to building protection mode

7.11.1.1 Parameter and communication object tables

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

Nome oggetto	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Windows contact sensor 1 (from bus)	Window contacts function = enabled, Window contact 1 = enabled	1 Bit	C-W--	[1.019] window/door	13
Windows contact sensor 2 (from bus)	Window contacts function = enabled, Window contact 2 = enabled	1 Bit	C-W--	[1.019] window/door	14

7.11.2 Presence sensors

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

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

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

External sensors (from bus) ⇒ Presence sensor 1 (from bus) or Presence sensor 2 (from bus) = enabled

7.11.2.1 Parameter and communication object tables

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

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Presence sensor 1 (from bus)	Presence sensor function= enabled	1 Bit	C-W---	[1.018] occupancy	15
Presence sensor 2 (from bus)	Presence sensor function = enabled	1 Bit	C-W---	[1.018] occupancy	16

7.11.3 Card holder

The ***Card holder*** secondary folder appears only if the corresponding sensor is enabled i.e. if the following condition is true: External sensors (from bus) ⇒ Card holder contact = enabled

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

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

7.11.3.1 Parameter and communication object tables

Parameter name	***Conditions***	***Values***
Card holder function		**disabled** / enabled
	Parameter that enables the card holder function.	
On card insertion switch HVAC mode to	Card holder function = enabled	none **comfort** standby economy
	This parameter defines to which operating mode the device should automatically switch inserting the card into the holder.	
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 the automatic switching of the operating mode, inserting the card into the holder.	
On card removal switch HVAC mode to	Card holder function = enabled	none **standby** economy building protection
	This parameter defines to which operating mode the device should automatically switch removing the card from the holder.	
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 the automatic switching of the operating mode, removing the card from the holder.	

Object name	***Conditions***	***Dim.***	***Flags***	***DPT***	***Comm. Obj. No.***
Card holder contact sensor (from bus)	Card holder function = enabled	1 Bit	CR-T--	[1.018] occupancy	17

About card holder function

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

Conventional (not KNX) card holder

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

KNX card holder

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

7.12 Logic functions

The EK-E72-TP KNX room thermostat (71 series) allows to use some useful logic functions (AND, OR, NOT and exclusive OR) in order to implement complex functions in the building automation system.

You can configure:

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

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

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

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

The communicaton function representing the logic function output is sent on the bus on event of change; alternatively, a cyclic sending can be set.

7.12.1 Parameter and communication object tables

The following condition has to be true: General ⇒ Logic functions = enabled.

Parameter name	***Conditions***	***Values***
Logic function		**disabled** / enabled
Logic operation	Logic function = enabled	**OR** / AND / XOR
	XOR (eXclusive OR)	
Delay after bus voltage recovery		**00:00:04.000 hh:mm:ss.fff** [range 00:00:00.000 … 00:10:55.350]
	Time interval between the bus voltage recovery and the first reading of the input communication objects for evaluating the logic functions	
Output cyclic transmission delay		**no sending** [other value in range 30 s … 120 min]
	No sending means that the output state of the logic function is updated on the bus only on change. Different values imply cyclic sending on the bus of the output state.	
Logic object x		**disabled** / enabled
Negated	Logic object x = enabled	**no** / yes
	Negando lo stato logico dell’ingresso corrispondente, è possibile realizzare logiche combinatorie articolate. Esempio: Output=(NOT(Oggetto logico 1) OR Oggetto logico 2).	
Read at startup	Logic object x = enabled	**no** / yes
Default value	Logic object x = enabled	**none** / off / on

Object name	Conditions	Dim.	Flags	DPT	Comm. Obj. No.
Logic function X – Input 1	Logic function X = enabled Logic object 1 = enabled	1 Bit	C-W--	[1.001] switch	77, 82, 87, 92, 97, 102, 107, 112
Logic function X – Input 2	Logic function X = enabled Logic object 2 = enabled	1 Bit	C-W--	[1.001] switch	78, 83, 88, 93, 98, 103, 108, 113
Logic function X – Input 3	Logic function X = enabled Logic object 3 = enabled	1 Bit	C-W--	[1.001] switch	79, 84, 89, 94, 99, 104, 109, 114
Logic function X – Input 4	Logic function X = enabled Logic object 4 = enabled	1 Bit	C-W--	[1.001] switch	80, 85, 90, 95, 100, 105, 110, 115
Logic function X – Output	Logic function X = enabled	1 Bit	C-W--	[1.001] switch	81, 86, 91, 96, 101, 106, 111, 116

8 List of communication objects

Nr.	Name	Size	Flags	Datapoint type
0	Technical alarm	1 Bit	-WC---	[1.5] DPT_Alarm
1	Temperature value	2 Byte	R-CT--	[9.1] DPT_Value_Temp
2	Temperature threshold 1 - Switch	1 Bit	R-CT--	[1.1] DPT_Switch
3	Temperature threshold 2 - Switch	1 Bit	R-CT--	[1.1] DPT_Switch
4	Brightness value (from bus)	2 Byte	-WC---	[9.4] DPT_Value_Lux
5	Room temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
6	Humidity (2 bytes, from bus)	2 Byte	-WC---	[9.7] DPT_Value_Humidity
7	Humidity (1 byte, from bus)	1 Byte	-WC---	[5.1] DPT_Scaling
8	Antistratification temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
9	Outdoor temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
10	Coil temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
11	Floor temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
12	Flow temperature (from bus)	2 Byte	-WC---	[9.1] DPT_Value_Temp
13	Windows contact sensor 1 (from bus)	1 Bit	-WC---	[1.19] DPT_Window_Door
14	Windows contact sensor 2 (from bus)	1 Bit	-WC---	[1.19] DPT_Window_Door
15	Presence sensor 1 (from bus)	1 Bit	-WC---	[1.18] DPT_Occupancy
16	Presence sensor 2 (from bus)	1 Bit	-WC---	[1.18] DPT_Occupancy
17	Contact of card holder (from bus)	1 Bit	-WC---	[1.18] DPT_Occupancy
18	Anticondensation (from bus)	1 Bit	-WC---	[1.1] DPT_Switch
19	Weighted temperature	2 Byte	R-CT--	[9.1] DPT_Value_Temp
20	Heating/cooling status out	1 Bit	R-CT--	[1.100] DPT_Heat_Cool
21	Heating/cooling status in	1 Bit	-WC---	[1.100] DPT_Heat_Cool
22	HVAC mode in	1 Byte	-WC---	[20.102] DPT_HVACMode
23	HVAC forced mode in	1 Byte	-WC---	[20.102] DPT_HVACMode
24	HVAC mode out	1 Byte	R-CT--	[20.102] DPT_HVACMode
25	HVAC manual mode	1 Byte	-WCTU-	[20.102] DPT_HVACMode
26	Chrono active status	1 Bit	R-CT--	[1.11] DPT_State
27	Actual setpoint	2 Byte	R-CT--	[9.1] DPT_Value_Temp
28	Manual setpoint	2 Byte	-WC---	[9.1] DPT_Value_Temp
29	Comfort setpoint (heating)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
30	Comfort setpoint (cooling)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
31	Standby setpoint (heating)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
32	Standby setpoint (cooling)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
33	Economy setpoint (heating)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
34	Economy setpoint (cooling)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
35	Building protection setpoint (heating)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
36	Building protection setpoint (cooling)	2 Byte	RWCTU-	[9.1] DPT_Value_Temp
37	Temperature setpoint change lock	1 Bit	-WC---	[1.3] DPT_Enable
38	Heating out command	1 Bit	R-CT--	[1.1] DPT_Switch
38	Heating out command	1 Byte	R-CT--	[5.1] DPT_Scaling
38	Heating and cooling out command	1 Bit	R-CT--	[1.1] DPT_Switch

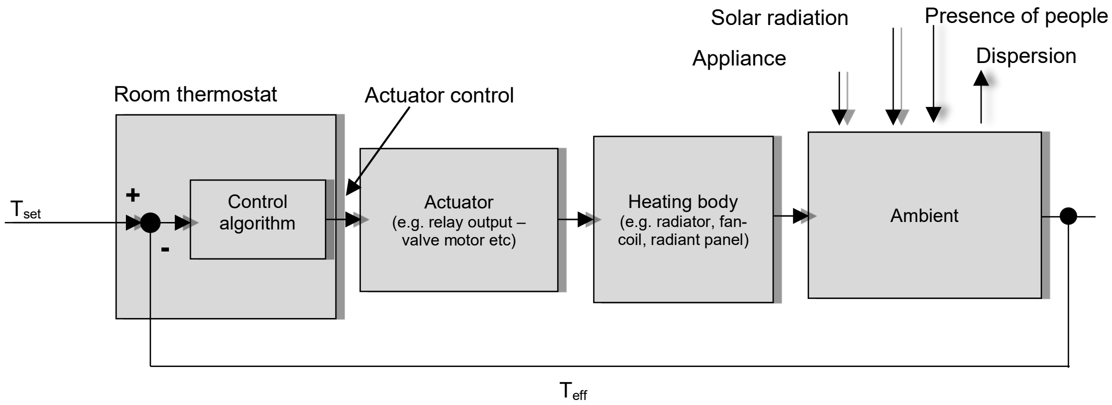
Nr.	Name	Size	Flags	Datapoint type
38	Heating and cooling out command	1 Byte	R-CT--	[5.1] DPT_Scaling
39	Cooling out command	1 Bit	R-CT--	[1.1] DPT_Switch
39	Cooling out command	1 Byte	R-CT--	[5.1] DPT_Scaling
40	Auxiliary heating out command	1 Bit	R-CT--	[1.1] DPT_Switch
40	Auxiliary heating and cooling out command	1 Bit	R-CT--	[1.1] DPT_Switch
41	Auxiliary cooling out command	1 Bit	R-CT--	[1.1] DPT_Switch
42	Auxiliary heating disable	1 Bit	-WC---	[1.3] DPT_Enable
43	Auxiliary cooling disable	1 Bit	-WC---	[1.3] DPT_Enable
44	Fan continuous speed	1 Byte	R-CT--	[5.1] DPT_Scaling
45	Fan speed 1	1 Bit	R-CT--	[1.1] DPT_Switch
46	Fan speed 2	1 Bit	R-CT--	[1.1] DPT_Switch
47	Fan speed 3	1 Bit	R-CT--	[1.1] DPT_Switch
48	Fan control disable	1 Bit	-WC---	[1.2] DPT_Bool
49	Manual mode lock	1 Bit	-WC---	[1.3] DPT_Enable
50	Manual/forced setpoint active status	1 Bit	RWCTU-	[1.11] DPT_State
51	Fan manual speed	1 Byte	RWCTU-	[5.10] DPT_Value_1_Ucount
52	Fan speed status	1 Byte	R-CT--	[5.10] DPT_Value_1_Ucount
53	Fan manual active status	1 Bit	RWCTU-	[1.11] DPT_State
54	HVAC scene number	1 Byte	-WC---	[17.1] DPT_SceneNumber, [18.1] DPT_SceneControl
55	Comfort state	1 Bit	R-CT--	[1.6] DPT_BinaryValue
56	Dew-point temperature	2 Byte	R-CT--	[9.1] DPT_Value_Temp
57	Perceived temperature	2 Byte	R-CT--	[9.1] DPT_Value_Temp
58	Relative humidity setpoint for dehumidification	2 Byte	RWCTU-	[9.7] DPT_Value_Humidity
59	Relative humidity setpoint for humidification	2 Byte	RWCTU-	[9.7] DPT_Value_Humidity
60	Dehumidification command	1 Bit	R-CT--	[1.1] DPT_Switch
61	Dehumidification water battery command	1 Bit	R-CT--	[1.1] DPT_Switch
62	Dehumidification integration control	1 Bit	R-CT--	[1.1] DPT_Switch
63	Dehumidification control disable	1 Bit	-WC---	[1.3] DPT_Enable
64	Humidification command	1 Bit	R-CT--	[1.1] DPT_Switch
65	Humidification control disable	1 Bit	-WC---	[1.3] DPT_Enable
66	Anticondensation alarm	1 Bit	R-CT--	[1.5] DPT_Alarm
67	Leds intensity percentage	1 Byte	-WC---	[5.1] DPT_Scaling
68	Thermal generator lock	1 Bit	-WC---	[1.5] DPT_Alarm
69	Alarm 1 (from bus)	1 Bit	-WC---	[1.5] DPT_Alarm
70	Alarm 2 (from bus)	1 Bit	-WC---	[1.5] DPT_Alarm
71	Alarm 3 (from bus)	1 Bit	-WC---	[1.5] DPT_Alarm
72	Alarm 4 (from bus)	1 Bit	-WC---	[1.5] DPT_Alarm
73	Rockers lock	1 Bit	-WC---	[1.2] DPT_Bool
74	Building protection HVAC mode active	1 Bit	R-CT--	[1.011] DPT_State
75	Fan manual speed percentage	1 Byte	R-CT--	[5.001] DPT_Percentage
76	Fan manual speed off status	1 Bit	R-CT--	[1.011] DPT_State

Nr.	Name	Size	Flags	Datapoint type
77, 82, 87, 92, 97, 102, 107, 112	Logic function X – Input 1	1 Bit	-WC---	[1.1] DPT_Switch
78, 83, 88, 93, 98, 103, 108, 113	Logic function X – Input 2	1 Bit	-WC---	[1.1] DPT_Switch
79, 84, 89, 94, 99, 104, 109, 114	Logic function X – Input 3	1 Bit	-WC---	[1.1] DPT_Switch
80, 85, 90, 95, 100, 105, 110, 115	Logic function X – Input 4	1 Bit	-WC---	[1.1] DPT_Switch
81, 86, 91, 96, 101, 106, 111, 116	Logic function X – Output	1 Bit	R-CT--	[1.1] DPT_Switch

9 Control algorithms

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

The picture below shows the components of a common generic control system for ambient temperature. The room thermostat measures the actual temperature of the air mass (T_{eff}) and constantly compares it to the setpoint value (T_{set}).

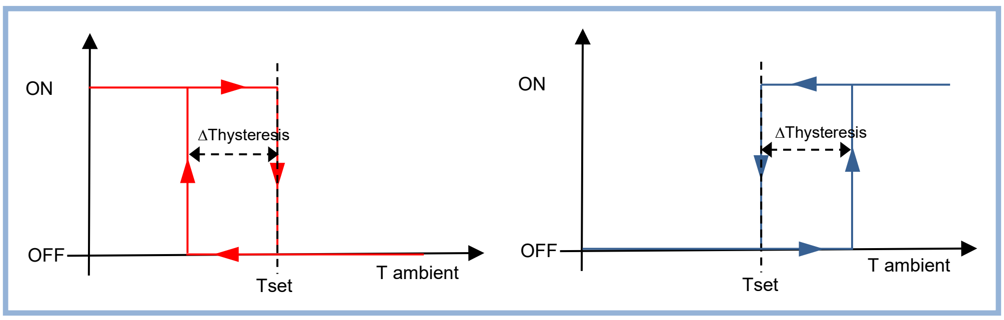


The control algorithm, basing on the difference between T_{set} and T_{eff}, processes a command value which can be of analog or On / Off type; the command is represented by a CO that is transmitted via bus, either periodically or event based, to a KNX actuator device.

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

9.1 Two-point control with hysteresis

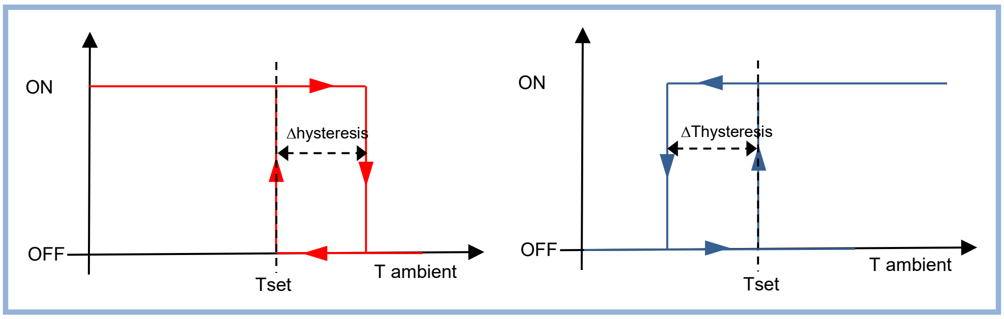
This control algorithm, which is also known as On / Off, is the most classic and popular. The control provides for the on / off switching of the system following a hysteresis loop, i.e. two threshold levels are considered for the switching instead of a single one.



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

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

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



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

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

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

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

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

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

9.2 Continuous Proportional-Integral control

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

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

whereby:

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

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

$Kp = proportional\ constant$

$Ki = intgral\ constant$

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

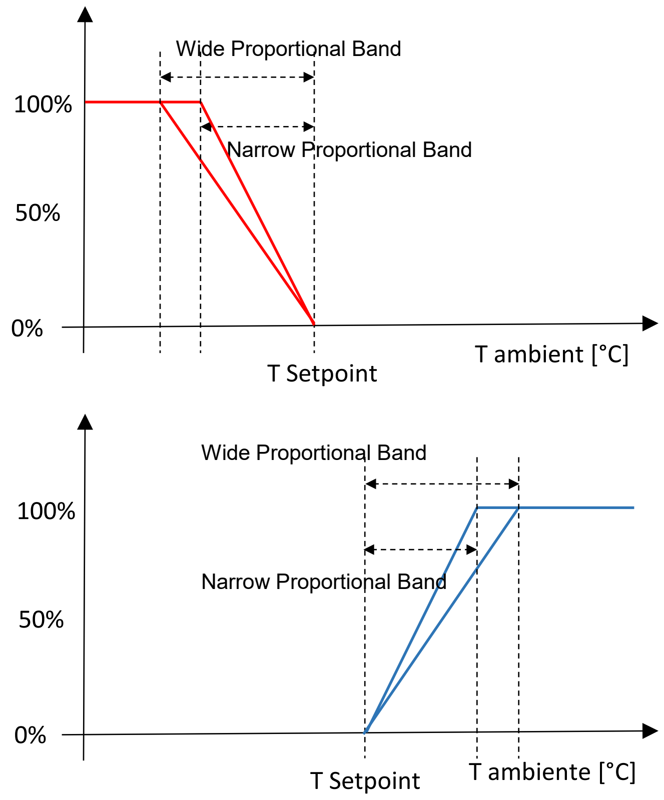
Practically, some more intuitive values are used:

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

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

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

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

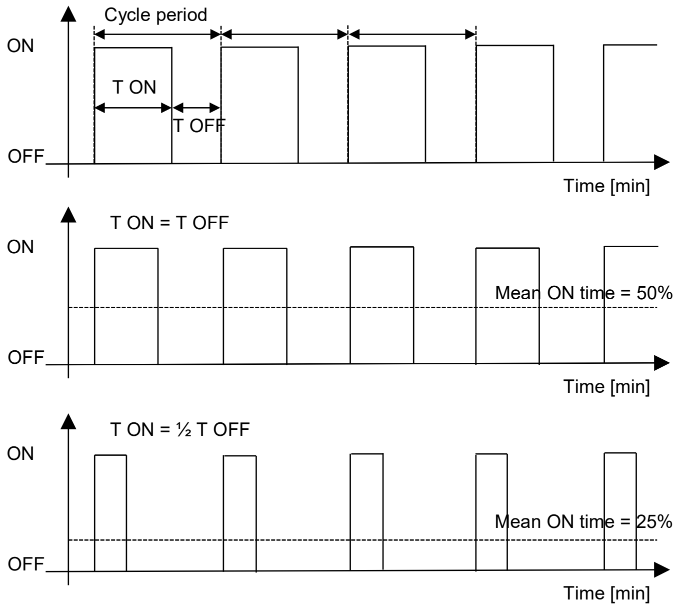


Integral Time is the amount of time necessary to repeat the vaue of the control variable of a purely proportional controller, when error is constant. For example, with a purely proportional controller with Proportional Band = 4 K, if Setpoint = 20°C and Measured Temperature = 18°C, the control variable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

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

9.3 PWM Proportional-Integral controll

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



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

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

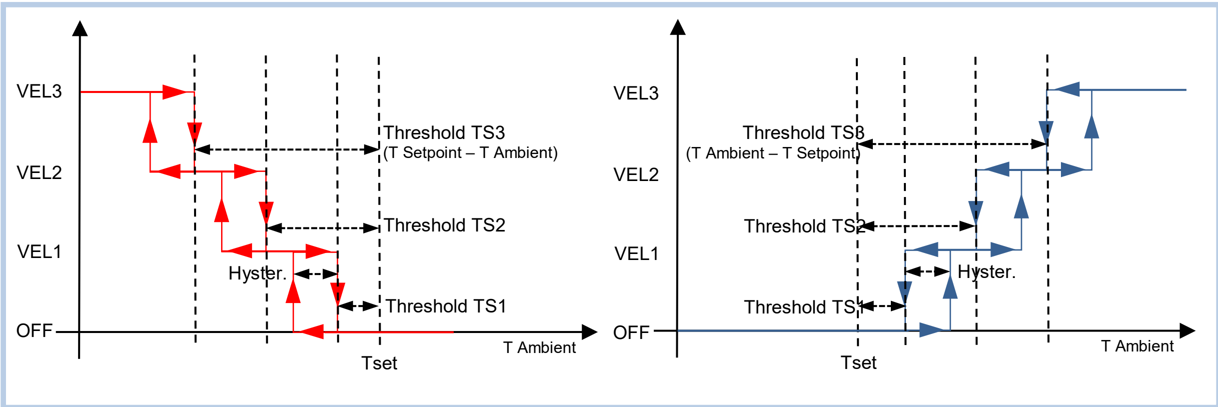
Terminal type	Proportional Band [K]	Integral Time [min]	Cycle Period [min]
Radiators	5	150	15-20
Electrical heaters	4	100	15-20
Fan-coil	4	90	15-20
Floor radiant panels	5	240	15-20

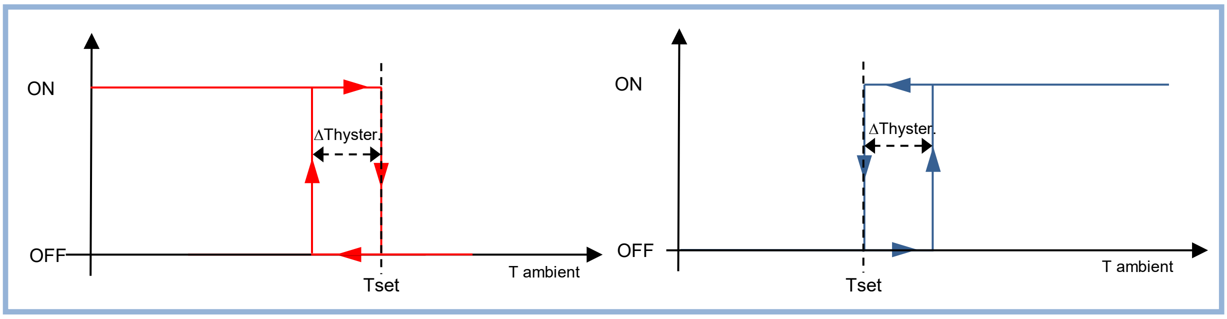
Guidelines for choosing the proper parameters of a PMW Proportional-Integral controller:

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

9.4 Fan-coils with On / Off fan speed control

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





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

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

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

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

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

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

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

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

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

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

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

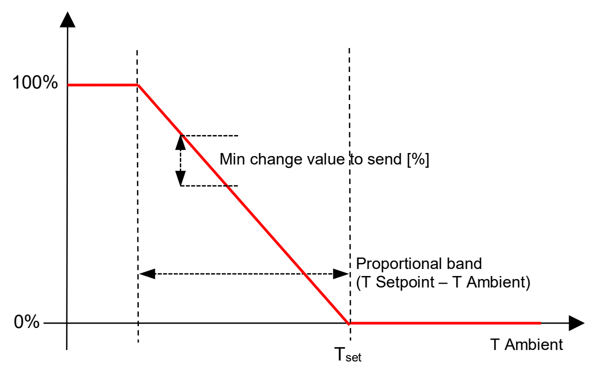
The communication between the controller and the actuator can be realized both with communication objects [1.1] DPT_Switch (168-169-170, Fan speed 1-2-3) or with a single object [5.1] DPT_Scaling (167, continuous fan speed). The object (167, continuous fan speed), with ON/OFF fan coil speed control, does not change continuously but gets discrete values according to the hysteresis of the ON/OFF windows, as shown in the following table.

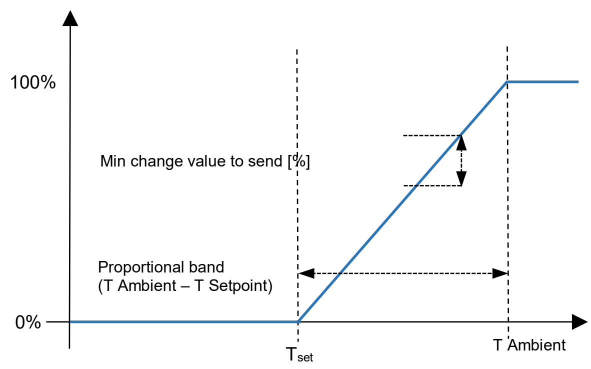
Automatic fan speed	Fan speed communication objects, type [1.1] DPT_Switch			Continuous fan speed communication object, [5.1] DPT_Scaling
	V1	V2	V3	
Control type: 3-speed				
OFF	0	0	0	0 %
1	1	0	0	33,3 %
2	0	1	0	66,7 %
3	0	0	1	100 %
Control type: 2-speed				
OFF	0	0	-	0 %
1	1	0	-	50 %
2	0	1	-	100 %
Control type: 1-speed				
OFF	0	-	-	0 %
1	1	-	-	100 %

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

9.5 Fan coil with fan speed continuous control

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





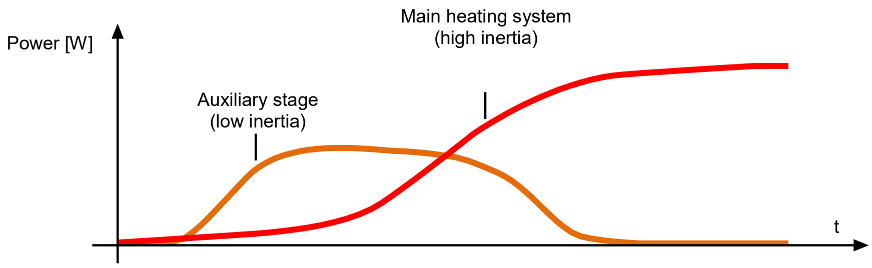
The definiton of hyteresis levels must be directly performed on the fan coil actuator. The application program offers the parameter *Proportional band*, which has the the same value for both heating and cooling: this parameter determines the fan intervention gradient. The parameter *Min. change of value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

i	The 1-byte communication object *Continuous fan speed* (167) changes continuously according to the curve shown in figure. Please refer to the previous paragraph to evaluate differences with the 1-2-3-speed control, where the same communication object has discrete values.

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

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

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

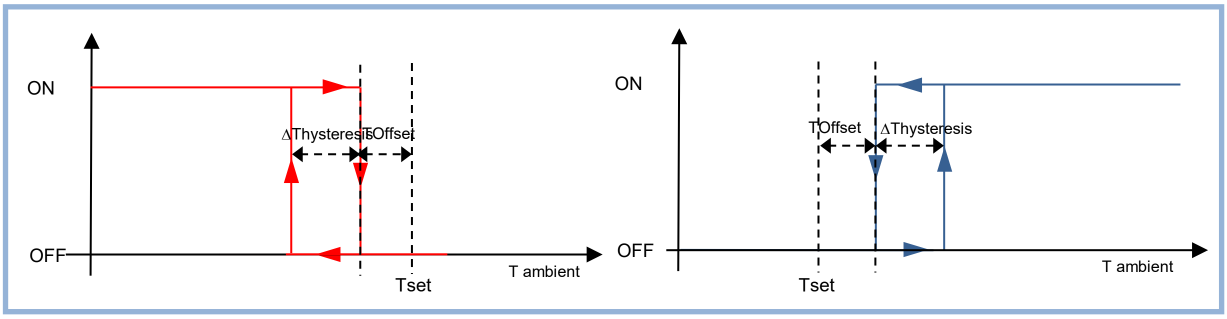


The auxiliary – also called "second-tier" – system, in the initial stage, contributes to heat / cool the environment and then stops its action when the difference between T_{set} and Teff is lower and can be addressed by the system with higher inertia.

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

<u>Heating mode</u>

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

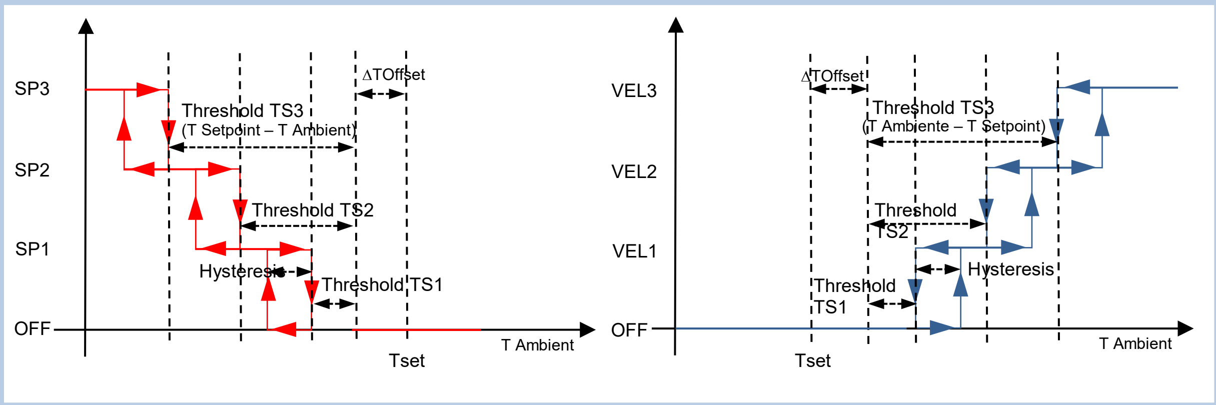


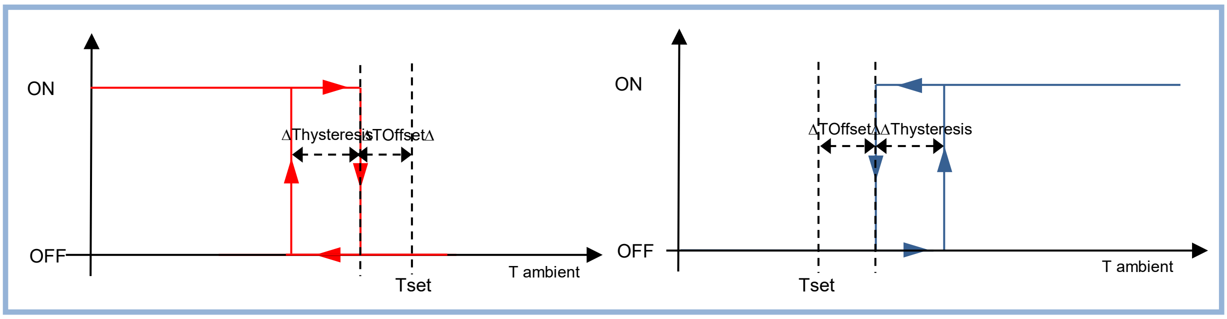
<u>Cooling mode</u>

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

9.7 Auxiliaty stage with fan coil

In some heating / cooling system, an auxiliary fan coil system which operates on air volumes is paired with an high inertial system (such as floor radiant panels): EK-E72-TP thermostats can be easily configured for this kind of application.





As for the configuration of the auxiliary stage, you can apply the same rules already expressed in the ON/OFF and continuous fan coil control paragraph. Particularly relevant here is the auxiliary stage intervention offset, ΔT_{Offset}, which matches the parameter *Setpoint difference* in *Heating and/or cooling* folder. By configuring this parameter (which can be different between heating and cooling if command communication objects are separated) to 0 K, the radiant panel and the fan coil work as 2 heating and/or cooling devices in parallel. Otherwise, if *Setpoint difference* > 0 K, the fan coil intervenes very quickly in the first tuning stages and leaves to the radiant panel the job of reaching the desired temperature.

10 Diagnostics

Alarm code	Cause
A01	Surface temperature limit is exceeded
A02	Formation of condensation
A03	Thermal generator lock
F01	Alarm 1 (from bus)
F02	Alarm 2 (from bus)
F03	Alarm 3 (from bus)
F04	Alarm 4 (from bus)
Alarm code	**Cause**
E00	Integrated temperature sensor fault
E23	CO: external temperature sensor fault
E24	CO: room temperature sensor fault
E25	CO: fan-coil temperature sensor fault
E26	CO: surface temperature sensor fault
E27	CO: flow temperature sensor fault
E28	CO: relative humidity sensor fault
E29	CO: antistratification temperature sensor fault
E30	CO: room brightness sensor fault
E34	CO: external temperature sensor timeout
E35	CO: room temperature sensor timeout
E36	CO: fan-coil temperature sensor timeout
E37	CO: surface temperature sensor timeout
E38	CO: flow temperature sensor timeout
E39	CO: relative humidity sensor timeout
E40	CO: antistratification temperature sensor timeout
E41	CO: anticondensation sensor timeout
E42	CO: window contact 1 timeout
E43	CO: window contact 2 timeout
E44	CO: presence sensor 1 timeout
E45	CO: presence sensor 2 timeout
E46	CO: card holder contact timeout
E47	CO: room brightness sensor timeout

Table of alarm and error displayable codes.

11 Warnings

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

12 Other information

- The instruction sheet must be delivered to the end customer with the project documentation
- For further information on the product, please contactthe ekinex® technical support at the e-mail address: support@ekinex.com or visit the website www.ekinex.com
- Each ekinex® device has a unique serial number onthe label. The serial number can be used by installersor system integrators for documentation purposes and has to be added in each communication addressed to the EKINEX technical support in case of malfunctioning of the device
- ekinex® is a registered trademark of EKINEX S.p.A.
- KNX® and ETS® are registered trademarks of KNX Association cvba, Brussels