State 11/2022 Version 1.1

Technical Manual

MDT Room Temperature Controller

SCN-RT1UP.01

SCN-RT1UPE.01

SCN-TS1UP.01

SCN-RT1APE.01 no longer available

Further Documents:

Datasheet:
https://www.mdt.de/EN_Downloads_Datasheets.html

Assembly and Operation Instructions:
https://www.mdt.de/EN_Downloads_Instructions.html

Solution Proposals for MDT products:
https://www.mdt.de/EN_Downloads_Solutions.html

1 Content

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2 Overview

2.1 Overview devices

The manual refers to the following devices, which are in our assortment of room temperature controller (Order Code respectively printed in bold type):

- **SCN-RT1UP.01** Room temperature controller 1-fold, flush mounted
  - integrated temperature controller: Two-position, PI, PWM
- **SCN-RT1APE.01** Room temperature controller 1-fold, surface mounted, with adjustment knop
  - integrated temperature controller: Two-position, PI, PWM
- **SCN-RT1UPE.01** Room temperature controller 1-fold, flush mounted, with adjustment knob
  - integrated temperature controller: Two-position, PI, PWM
- **SCN-TS1UP.01** Room temperature sensor 1-fold
  - Sensor for measuring the room temperature, without controller function

2.2 Usage & Possible applications

The room temperature controller has its areas of use at the controlling in home installations and in the object range.
A lot of different controls can be realized by the room temperature controller. There are three integrated controllers, which can be adjusted to the present system. The three controllers can control as well heating systems as cooling systems. There are setting options for up to 4 different operating modes. Additional levels, blocking functions, settings of external sensors and guiding can also be adjusted.

An exception is the SCN-TS1UP.01. This is only a sensor for measuring the temperature. There are no integrated temperature controllers at this device. The temperature sensor has its areas of use at the measuring of temperatures for other controllers.

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2.3 Exemplary circuit diagram

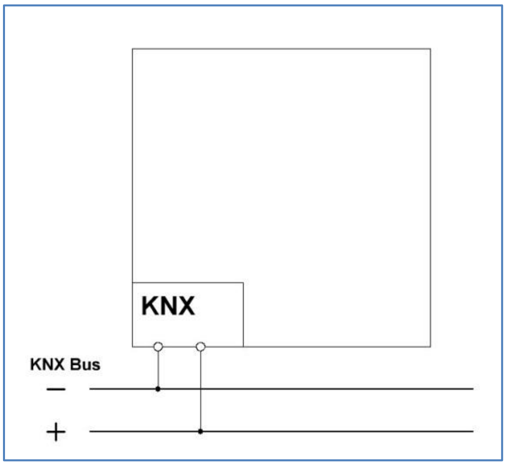

Figure 1: Exemplary circuit diagram

2.4 Structure & Handling

The temperature controller is available in three different versions, as a flush-mounted device, for surface mounting and for mounting in control cabinets or on DIN rails. The devices each have a bus connection terminal and a programming button, as well as a programming LED.

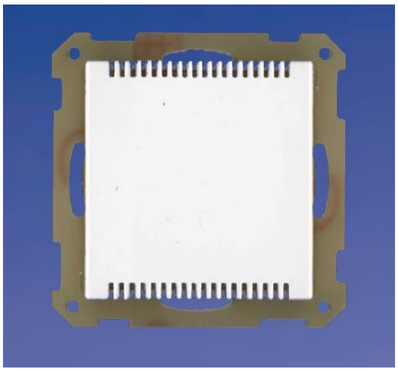

Figure 2: SCN-RT1UP.01

Figure 3: SCN-RT1APE.01

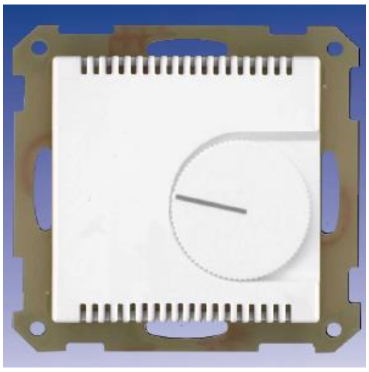

Figure 4: SCN-RT1UPD.01

The room temperature sensor, SCN-TS1UP.01, is for flush-mounting. It contains also of a bus-connection, a programming button and a programming LED.
Housing shape corresponds to that of the SCN-RT1UP.01.

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2.5 Functions

The controller has 5 different setting ranges, which are subdivided as follows:

- **Setup general**
  General settings can be made at this menu and the used device can be chosen.
- **Temperature measurement**
  The settings for the measurement for the temperature can be made at this menu. Settings for the min/max values and the sensor configuration are available at this parameter.
  All sensors contain of an in-plant balance.
- **Alarm/Messages**
  Alarms and messages can be adjusted at this menu. This alarms and messages report when the temperature falls below an adjusted value or exceed an adjusted value.
- **Controller general**
  At this menu, the desired function (heating, cooling or heating & cooling) can be assigned and general settings, like setpoints, can be adjusted.
- **Controller settings**
  This menu appears as soon as the controller has got a function assigned. Integrated controllers can be chosen at this menu and the chosen controller can be parameterized further.

The temperature sensor SCN-TS1UP.01 only has "Setup general", "Temperature measurement" and "Alarm/Messages".

2.6 Commissioning

After wiring the allocation of the physical address and the parameterization of every channel follow:

(1) Connect the interface with the bus, e.g. MDT USB interface
(2) Switch-on bus voltage
(3) Press the programming button at the device (red programming LED lights)
(4) Loading of the physical address out of the ETS-Software by using the interface (red LED turns off as soon as the process is successfully completed)
(5) Loading of the application, with requested configuration
(6) If the device is enabled, you can test the requested functions (also possible by using the ETS-Software)

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3 Communication objects

3.1 Default settings of the communication objects

The following chart shows the default settings for the communication objects:

Default settings								
Nr.	**Name**	**Object Function**	**Length**	**C**	**R**	**W**	**T**	**U**
0	Actual temperature value	Transmit temperature value	2 Byte	X	X		X	
1	Higher message value	Send message	1 Bit	X	X		X	
2	Lower message value	Send message	1 Bit	X	X		X	
3	Frost alarm	Send alarm	1 Bit	X	X		X	
4	Heat alarm	Send alarm	1 Bit	X	X		X	
5	External sensor	Read external sensor	2 Byte	X		X		
6	Setpoint comfort	Set setpoint	2 Byte	X	X	X	X	
7	Manual setpoint value offset	Reduction/Increase	2 Byte	X		X		
8	Control value heating	Send control value	1 Bit	X	X		X	
8	Control value heating	Send control value	1 Byte	X	X		X	
8	Control value heating/cooling	Send control value	1 Bit	X	X		X	
8	Control value heating/cooling	Send control value	1 Byte	X	X		X	
9	Control value additional heating	Send control value	1 Bit	X	X		X	
10	Control value cooling	Send control value	1 Bit	X	X		X	
10	Control value cooling	Send control value	1 Byte	X	X		X	
10	Status Cooling/Heating	0= Cooling, 1=Heating	1 Bit	X	X		X	
11	Mode comfort	Switch mode	1 Bit	X	X	X		
12	Mode night	Switch mode	1 Bit	X	X	X		
13	Mode frost/heat protection	Switch mode	1 Bit	X	X	X		
14	Heating disable object	Disable heating	1 Bit	X		X		
15	Cooling disable object	Disable cooling	1 Bit	X		X		
17	Heating request	Send request	1 Bit	X	X		X	
18	Cooling request	Send request	1 Bit	X	X		X	
19	Heating/Cooling switchover	0= Cooling, 1=Heating	1 Bit	X		X	X	
20	Guiding value	Setpoint adjustment	2 Byte	X	X	X		
21	Max memory value	Read memory	2 Byte	X	X	X	X	
22	Min memory value	Read memory	2 Byte	X	X	X	X	
23	Min/Max memory reset	Reset memory	1 Bit	X		X	X	
24	Reset setpoint value	Parameter read in	1 Bit	X		X		
25	DPT_HVAC Status	Send controller status	1 Byte	X	X		X	
28	Error external Sensor	Error message	1 Bit	X	X		X	
29	Actual setpoint	Send setpoint	2 Byte	X	X		X	

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30	DPT_RHCC	Send controller status	2 Byte	X	X		X	
31	Mode selection	Select mode	1 Byte	X		X	X	
32	Manual setpoint value offset	Increase / Reduction (1=+/0=-)	1 Bit	X		X		

Table 1: Communication objects – Default settings

You can see the default values for the communication objects from the upper chart. According to requirements the priority of the communication objects as well as the flags can be adjusted by the user. The flags allocate the function of the objects in the programming thereby stands C for communication, R for Read, W for write, T for transmit and U for update.

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4 Reference ETS-Parameter

4.1 Setup general

The following settings are available:

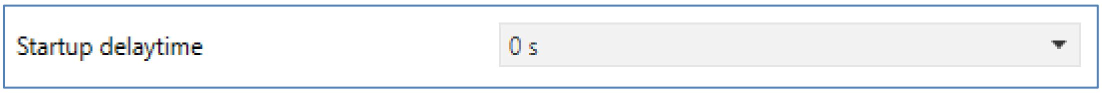

Figure 5: General settings

The chart shows the dynamic range of the general settings:

ETS-text	Dynamic range **[default value]**	Comment
Startup delaytime	0 – 60 s **[0]**	Time that elapses between bus voltage return and functional start of the device.

Table 2: General settings

Startup delaytime
This time defines when the unit "boots up" after a restart (reset, reprogramming, bus voltage return). This can be important if, for example, a bus reset is carried out. If there are many units on a line, all units would start at the same time and load the bus. With a variable time, the units can thus start differently.

The **SCN-TS1UP.01** is a pure temperature sensor, which does not contain of any controller functions. Therefore, only the menus 4.2 Temperature measurement and 4.3 Alarm/Messages are shown and can be configured.

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4.2 Temperature measurement

The following settings are available at the ETS-Software:

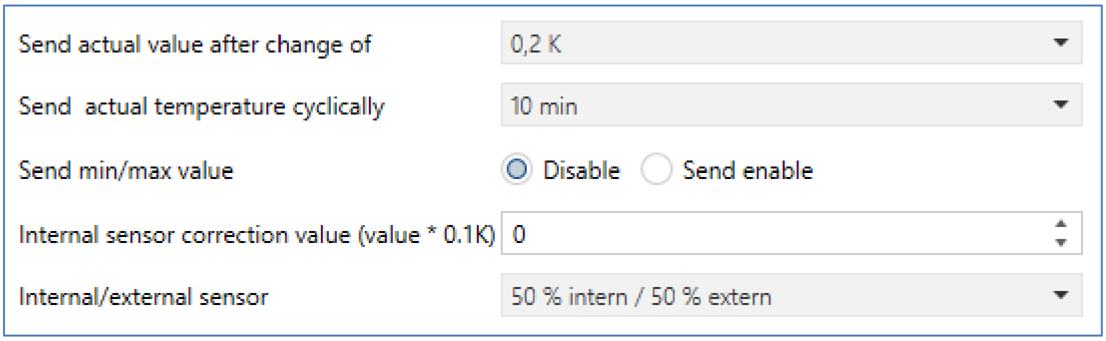

Figure 6: Settings – Temperature measurement

The following table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Send actual value after change of	**Disable,** 0,1K – 2,0K	Sending condition for the actual temperature value.
Send actual temperature cyclically	**Disable,** 1 min – 60 min	Activation of the cyclic sending of the temperature value.
Send min/max value	▪ **Disable** ▪ Send enable	Activation of the sending of min/max values.
Internal sensor correction value (value*0,1K)	-50 … 50 **[0]**	Correction of the internal sensor.
Internal/external sensor	▪ **100% intern** ▪ 90% intern/ 10% extern ▪ 80 % intern/ 20% extern ▪ … ▪ 100% extern	Adjustment of the balance between internal and external sensor.

Table 3: Settings – Temperature measurement

Send actual value after change of
This function sets when the current temperature value shall be sent. By choosing the setting "disable", no value will be sent at all.

Send actual temperature cyclically
You can activate this function by choosing a time. Now, the room temperature controller sends the current temperature periodically after the adjusted time. This function is independent from the function "Send actual value after change of". So the temperature controller will send its current value also if there is no change of it.

Internal sensor correction value (value*0,1K)
You can correct the measured temperature value by this setting. By choosing a negative value for this parameter, the measured value will be lowered and by choosing a positive value, the measured value will be lifted. The value is multiplied by 0,1K, so the current value can be lowered or lifted up to 5K. This setting is useful, when the sensor was built at an unfavourable location, e.g. becoming draft or next to a window. When this function is activated, the temperature controller will also send the corrected values.
All sensors are matched in-plant to 0,1K.

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The chart shows the relevant communication object for the temperature value:

Number	Name	Length	Usage
0	Actual temperature value	2 Byte	Sends the current temperature value

Table 4: Communication object – Temperature value

Send min/max value
This function activates the sending and saving of the min/max values. When the function is activated by “Send enable”, three communication objects will be shown. Two objects for the Min and the Max value and one for the reset of the min/max values.

The chart shows the relevant communication objects for this parameter:

Number	Name	Length	Usage
21	Max memory value	2 Byte	Sends and saves the maximal temperature value
22	Min memory value	2 Byte	Sends and saves the minimal temperature value
23	Min/Max memory reset	1 Bit	Resets the min/max values

Table 5: Communication objects – Min/Max values

Internal/external sensor
This setting sets the balance between an internal and an external sensor. The setting 100% intern deactivates any external sensor. By choosing any other setting, an external sensor will be activated. So, also communication objects for the external are shown. A balance of 100% extern deactivates the internal sensor and the temperature controller will only note values of the external sensor.

The communication objects for an activated external sensor are shown at the chart:

Number	Name	Length	Usage
5	External sensor	2 Byte	Sends the measured temperature value of the external sensor
28	Error external sensor	1 Bit	Sends an error when the external sensor sends no value for more than 30min

Table 6: Communication objects – External sensor

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4.3 Alarm/Messages

The following settings are available:

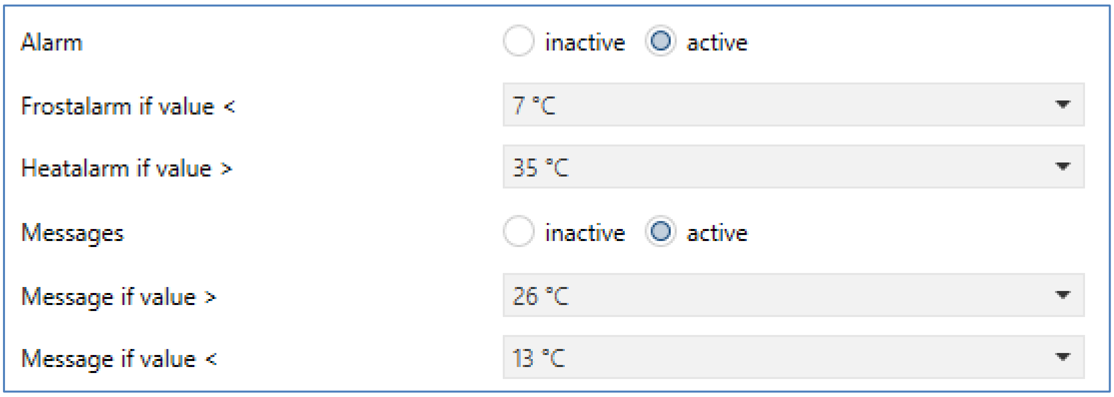

Figure 7: Settings – Alarm/Messages

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Alarm	▪ **not active** ▪ active	Activation of the alarm function.
Frost alarm if value <	3°C – 10°C **[7°C]**	Dynamic range of the frost alarm. Adjustment possible if alarm is activated.
Heat alarm if value >	25°C – 40°C **[35°C]**	Dynamic range of the heat alarm. Adjustment possible if alarm is activated.
Messages	▪ **not active** ▪ active	Activation of the message function.
Message if value >	18°C – 40°C **[26°C]**	Dynamic range of the upper message. Adjustment possible if messages are activated.
Message if value <	1°C – 25°C **[13°C]**	Dynamic range of the lower message. Adjustment possible if messages are activated.

Table 7: Settings – Alarm/Messages

If the "**Alarms**" function is activated, two alarm classifications can be configured. One is the alarm for the lower response value, the "Frost alarm", and the other is for the upper response value, the "Heat alarm". The two alarms each have a separate communication object, which can also be linked individually. The communication objects are each 1-bit objects.

The following communication objects are available:

Number	Name	Length	Usage
3	Frost alarm	1 Bit	Sending a frost alarm
4	Heat alarm	1 Bit	Sending a heat alarm

Table 8: Communication objects – Alarms

The “**Messages**” function is almost identical to the “Alarm” function, but less in its priority. There are two messages available, when the message function was activated. These two messages can be parameterized separately. The dynamic range of the message function is much bigger than the one of the alarm functions. So, it is also possible, to realize running turn over. Both messages have an own communication object of the size 1 bit.

The following communication objects are available:

Number	Name	Length	Usage
1	Higher message value	1 Bit	Sends a message when the upper message limit is reached
2	Below message value	1 Bit	Sends a message when the lower message limit is reached

Table 9: Communication objects – Messages

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4.4 Controller general

4.4.1 Controller type

The following picture shows the available settings:

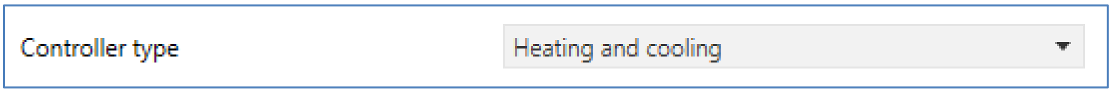

Figure 8: Settings – Controller type

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Controller type	▪ Controller off ▪ **Heating** ▪ Cooling ▪ Heating and Cooling	Adjustment of the controller type The further settings depend to the adjusted controller type.

Table 10: Settings – Controller type

The controller type defines the function of the room temperature controller. Target of the control is to keep an adjusted temperature constant. There are a lot of settings, which can help to achieve this aim. The settings depend to the adjusted controller type.
By choosing the setting “Controller off”, no further settings are possible.

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4.4.2 Operating modes & Setpoints

The following picture shows the available settings:

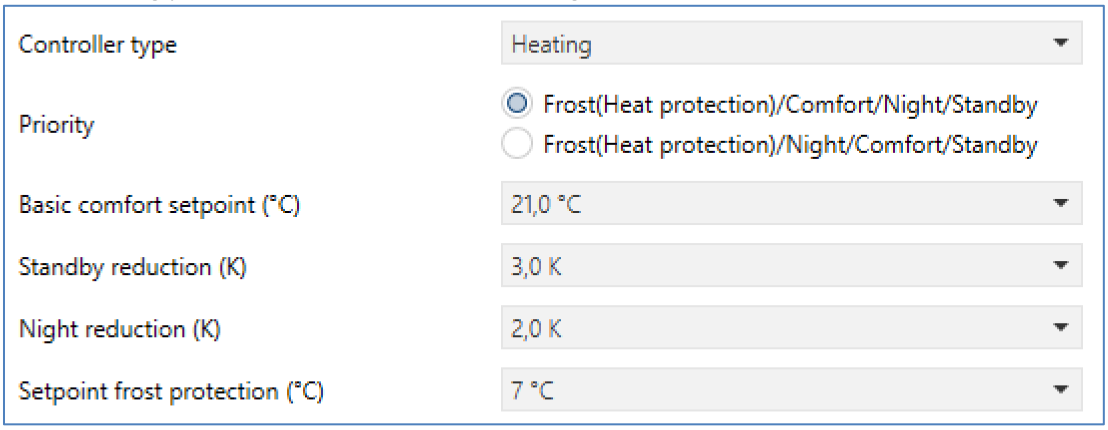

Figure 9: Settings – Operating modes & setpoints

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Basis comfort setpoint	18,0 °C – 25,0 °C **[21,0 °C]**	**The basis comfort setpoint is the reference point of the control.**
Night reduction/increase	0 K – 10,0 K **[2,0 K]**	Reduction (for "Heating") or increase (for "Cooling") of the temperature when the operating mode “Standby” is selected. Is indicated relative to the basic comfort value.
Standby reduction/increase	0 K – 10,0 K **[3,0 K]**	Reduction (for "Heating") or increase (for "Cooling") of the temperature when the operating mode “Night” is selected. Is indicated relative to the basic comfort value.
Setpoint frost protection	3 °C – 12 °C **[7 °C]**	Setpoint of the frost protection mode, is indicated as an absolute value. **Visible when "Heating" is active**.
Setpoint heat protection	24 °C – 40 °C **[35 °C]**	Setpoint of the heat protection mode, is Indicated as an absolute value. **Visible when "Cooling" is active.**

Table 11: Settings – Operating modes & setpoints

4.4.2.1 Operating mode Comfort

The "Comfort" operating mode is the reference operating mode of the controller. The values in the operating modes "Night" and "Standby" are based on this. The "Comfort" operating mode should be activated when the room is in use. The basic comfort value is configured as the setpoint.
If the controller type is set to "Heating & Cooling", the basic comfort value applies to the heating operation. In cooling mode, the value of the dead zone between "Heating" and "Cooling" is added.

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The following communication object is available for this:

Number	Name	Length	Usage
11	Mode comfort	1 Bit	Activation of the operating mode Comfort

Table 12: Communication object – Operating mode Comfort

4.4.2.2 Operating mode Night

The operating mode "Night" shall cause a significant decrement of the temperature, for example at night or at the weekend. The reduction can be programmed freely and refers to the basic comfort setpoint. If you have programmed a reduction of 5K and a basic comfort setpoint of 21°C, the setpoint for the "Night" mode will be 16°C.
The following communication object is available for this:

Number	Name	Length	Usage
12	Mode night	1 Bit	Activation of the operating mode Night

Table 13: Communication object – Operating mode Night

4.4.2.3 Operating mode Standby

The "Standby" operating mode is used when no one is using the room. It should cause a slight reduction/increase of the temperature. This value should be set significantly lower than the value for the "Night" operating mode to enable a faster reheating/cooling of the room. The value is freely configurable and refers to the basic comfort value. So if a setback of 2K has been set in the parameters and a basic comfort value of 21°C has been set, the setpoint for the 'Standby' operating mode is 19°C. In cooling mode, there is a corresponding increase in the value.
The "Standby" operating mode is then activated as soon as all other operating modes are deactivated. Thus, this operating mode also has no communication object.

4.4.2.4 Operating mode Frost/Heat protection

The "Frost protection" operating mode is activated as soon as the "Heating" function has been assigned to the controller, the "Heat protection" operating mode is activated as soon as the "Cooling" function has been assigned to the controller. If the "Heating & Cooling" function is assigned to the controller, a combined operating mode called "Frost/Heat Protection" is activated.
The "Frost/Heat protection" operating mode causes heating or cooling to be switched on automatically if the temperature falls below or exceeds the configured temperature. The temperature is set as an absolute value. If, for example, the temperature must not fall below a certain value during a longer absence, the "Frost protection" operating mode should be activated.
The following communication objects are available:

Number	Name	Length	Usage
13	Mode frost protection	1 Bit	Activation of the operating mode frost protection
13	Mode heat protection	1 Bit	Activation of the operating mode heat protection
13	Mode frost/heat protection	1 Bit	Activation of the operating mode frost/heat protection

Table 14: Communication objects – Operating mode Frost/Heat protection

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4.4.2.5 Priority of the operating modes

The table shows the available settings:

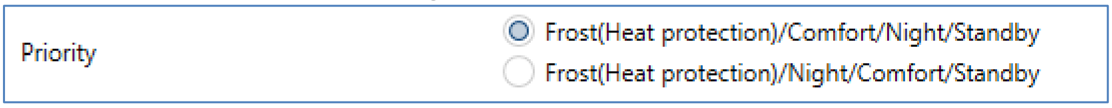

Figure 10: Settings – Priority of the operating modes

The chart shows the dynamic range of the priority of the operating modes:

ETS-text	Dynamic range **[default value]**	Comment
Priority	▪ **Frost/Comfort/Night/Standby** ▪ Frost/Night/Comfort/Standby	Setting the priority order.

Table 15: Settings – Priority of the operating modes

The priority setting of the operating modes can be used to set which operating mode is switched on with priority if several operating modes have been selected. If, for example, "Comfort" and "Night" are switched on simultaneously with the priority "Frost/Comfort/Night/Standby", the controller remains in "Comfort" mode until this is switched off. The controller then automatically switches to "Night" mode.

4.4.2.6 Operating mode switchover

There are 2 possibilities for the switchover of the operating modes: On the one hand the operating modes can be switched on by their 1 Bit communication object and on the other hand by a 1 Byte object (from DB V1.2).
The selection of the operating modes by their 1 Bit communication object occurs via a direct selection of their individual communication object. With consideration of the adjusted priority, the operating mode, which was selected via the 1 Bit communication object, is switched on or off. When all operating modes are switched off, the controller changes to the standby mode.

Example (priority to Frost/Comfort/Night/Standby").

Operating mode				adjusted operating mode
Comfort	Night	Frost-/ Heat protection		
1	0	0		Comfort
0	1	0		Night
0	0	1		Frost-/Heat protection
0	0	0		Standby
1	0	1		Frost-/Heat protection
1	1	0		Comfort

Table 16: Example switchover of the operating modes via 1 Bit

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The switchover of the operating modes via 1 Byte occurs by only one object, with the size of 1 Byte, the DPT_HVAC Mode 20.102 of KNX-specification. Additionally, there are 2 objects for the visualization available, the 1 Byte object “DPT_HVAC Status” and the 2 Byte object “DPT_RHCC Status”. For the switchover of the operating modes, a Hex-value is sent to the object “mode selection”. The object evaluates the received value and switches the belonging operating mode on and the active operating mode off. If all operating modes are switched off (Hex-value=0), the operating mode standby will be switched on.

The set hex values for the individual operating modes can be taken from the following table:

Operating mode (HVAC Mode)	Hex-Value
Comfort	0x01
Standby	0x02
Night	0x03
Frost/Heat protection	0x04

Table 17: Hex-Values for operating modes (from Version 1.2)

The following example shall clarify how the controller handles received Hex-values and switches operating modes on or off. The chart is to read from the top to the down.

Example (priority to “Frost/Comfort/Night/Standby”):

received Hex-value		Handling		adjusted operating mode
0x01		Comfort=1		Comfort
0x03		Comfort=0 Night=1		Night
0x02		Night=0 Standby=1		Standby
0x04		Frost-/Heat protection=1 Standby=0		Frost-/Heat protection

Table 18: Example operating mode switchover via 1 Byte (from Version 1.2)

The DPT HVAC Status communication, DPT_HVAC Status (without number) of KNX-specification, object sends the hex value for the adjusted operating mode. If several statements apply, the hex values are added and the status symbol then displays the added hex value. The hex values can then be read out by a visualisation.

The following chart shows the hex values for the single messages:

Bit	DPT HVAC Status		Hex-Value
0	Comfort	1=Comfort	0x01
1	Standby	1=Standby	0x02
2	Night	1=Night	0x04
3	Frost-/Heat protection	1= Frost-/Heat protection	0x08
4			
5	Heating/Cooling	0=Cooling/1=Heating	0x20
6			
7	Frost alarm	1=Frost alarm	0x80

Table 19: Hex-Values DPT HVAC Status (from Version 1.2)

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The object is used exclusively for status/diagnostic purposes. Furthermore, it is well suited for visualisation purposes. To visualise the object, it is easiest to evaluate the object bit by bit.
The object outputs the following values, for example:
0x21 = Controller in Heating operation with activated Comfort mode
0x01 = Controller in Cooling operation with activated Comfort mode
0x24 = Controller in Heating operation with activated Night mode

The DPT RHCC Status object is an additional 2 Byte status object with additional status messages. If more than one testify is valid, also here the values will be added in the same way as at the HVAC object.
The following chart shows the hex values for the single messages:

Bit	DPT RHCC Status		Hex-Value
0	Error Sensor	1=Error	0x01
8	Heating/Cooling	0=Cooling/1=Heating	0x100
13	Frost alarm	1=Frost alarm	0x2000
14	Heat alarm	1=Heat alarm	0x4000

Table 20: Hex-Values DPT RHCC Status (from Version 1.2)

The Controller reacts always to the value, which was sent last. If you switched the operating mode last via 1 Bit, the controller would react to the switchover by 1 Bit. If you switched the operating mode last via 1 Byte, the controller would react to the switchover by 1 Byte.
The communication objects for the mode selection are shown at the following chart. The first 3 communication objects are for the 1 Bit switchover, the last 3 objects are for the switchover via 1 Byte:

Number	Name	Length	Usage
11	Mode Comfort	1 Bit	Activation of the mode comfort
12	Mode Night	1 Bit	Activation of the mode night
13	Mode Frost/Heat protection	1 Bit	Activation of the mode Frost/ Heat protection
25	DPT_HVAC Status*	1 Byte	Visualization of the chosen operating mode
30	DPT_RHCC Status*	2 Byte	Visualization measuring/ status of the controller
31	mode selection*	1 Byte	Selection of the operating mode

Table 21: Communication objects – Operating mode switchover

* from DB Version 1.2

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4.4.2.7 Operating mode after reset

The following picture shows the available settings:

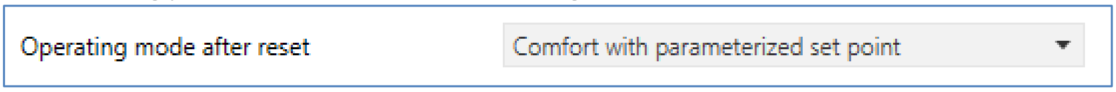

Figure 11: Settings – Operating mode after reset

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Operating mode after reset	▪ **Comfort with parameterized setpoint** ▪ Standby with parameterized setpoint ▪ Hold old state and setpoint	Setting which operating mode is to be activated after a bus voltage return.

Table 22: Settings – Operating mode after reset

This parameter defines the operating mode, which shall be adjusted after a bus power return. The controller can start with the “Comfort” mode or with the “Standby” mode. In both cases, the parameterized set point will be restored. By using setting “Hold old state and set point”, the controller restores the old operating mode and the set point, which was active before the reset. It must be pointed out, that the controller has no settings in its memory in case of an initial operation.

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4.4.3 Setpoint offset

The following picture shows the available settings:

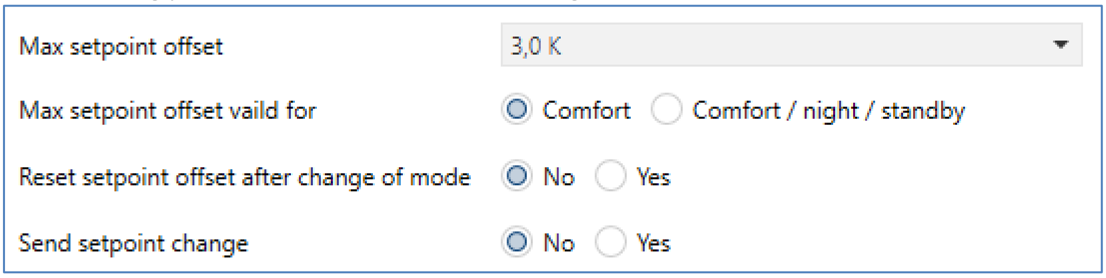

Figure 12: Settings – Setpoint offset

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Max setpoint offset	0 K – 10,0 K **[3,0 K]**	Indicates the maximal offset.
Max setpoint offset valid for	▪ **Comfort** ▪ Comfort/Night/Standby	Scope of the setpoint offset.
Reset setpoint offset after change of mode	▪ **No** ▪ Yes	Adjustment, whether a setpoint offset is still valid after change of operating mode or not.
Send setpoint change	▪ **No** ▪ Yes	Adjustment, whether a change of mode should be send or not.

Table 23: Settings – Setpoint offset

The setpoint can be changed manual by the setpoint offset without a new parameterization by the ETS-Software. Therefore, 2 variants are available. On the one hand a new setpoint can be pretended by the communication object “Setpoint comfort”. On the other hand, the adjusted setpoint can be increased or decreased manual by the communication object “manual setpoint value offset”.
At the read in of a new absolute comfort setpoint, the controller becomes a new basis comfort setpoint. The new basic comfort setpoint also causes an adaption of the indirect setpoints at the other operating modes. Through this function it is for example possible to read the actual room temperature as new basic comfort setpoint in. The settings “max setpoint offset”, “max setpoint offset valid for” and “Reset setpoint offset after change of mode” are not valid at this variant of setpoint offset, because the controller becomes a complete new setpoint. Specifying a new value is possible by calling the object “Setpoint comfort”.

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The second opportunity of the manual setpoint offset is the movement of the setpoint depending to the current adjusted setpoint. For this variant of setpoint offset, the object “manual setpoint value offset” is used. Sending a positive Kelvin value at this object causes an increment of the current setpoint. Sending a negative Kelvin value to this object causes a decrement of the current setpoint.

Only for unit with "set wheel": If the "**Setpoint offset with set wheel**" is activated, the communication object for manual setpoint adjustment is hidden. The manual setpoint adjustment is then carried out via the setting wheel.
Note: It should be noted that after an adjustment of the set wheel, it takes a few seconds until the new setpoint is sent on the bus.

The setting “**max setpoint offset**” indicates the maximal possible setpoint movement. If the controller is for example set to a basic comfort setpoint of 21°C and a maximum setpoint shift of 3K, the setpoint can only be shifted manual in the limits of 18°C and 24°C.

The setting “**max setpoint offset valid for**” defines the scope of the setpoint offset. You can choose whether the setpoint offset is only valid for the “Comfort” mode or also for the “Night” and “Standby” mode. The operating mode “Frost/Heat protection” is always independent of the setpoint offset.

The setting „**Reset setpoint after change of mode**” indicates whether a setpoint offset shall be maintained after a change of mode or not. If this parameter is deactivated, the device will switch to the adjusted setpoint for the chosen operating mode after every change of mode.

The communication object “Current setpoint” is for the query of the current setpoint at the actual adjusted operating mode.

The following communication objects are available for this:

Number	Name	Length	Usage
6	Setpoint comfort	2 Byte	Setting of a new absolute comfort setpoint
7	Manual setpoint value offset – Reduction/increase	2 Byte	Movement of the setpoint depending to the current adjusted basic comfort setpoint
29	Current setpoint	2 Byte	Sending the currently adjusted setpoint
32	Manual setpoint value offset – Reduction/increase (1=+/0=-)	1 Bit	Shifting the setpoint via 1 bit object

Table 24: Communication objects – Setpoint offset

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4.4.4 Lock objects

The following settings are available:

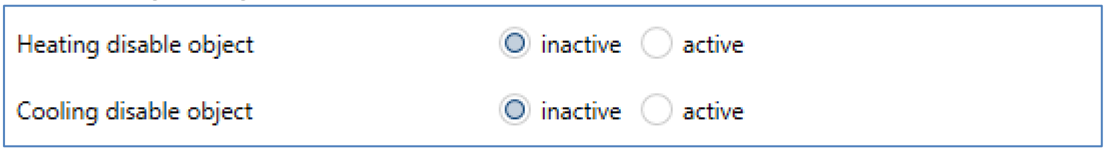

Figure 13: Settings – Lock objects

The following chart shows the dynamic range for this parameter:

ETS-text	Dynamic range **[default value]**	Comment
Heating disable object	▪ **inactive** ▪ active	Activates the lock object for the heating process.
Cooling disable object	▪ **inactive** ▪ active	Activates the lock object for the cooling process.

Table 25: Settings – Lock objects

By activating the lock objects, the user has one or two lock objects available for locking the control value, depending on the setting of the controller type. These lock objects serve to prevent the actuators (heating device or cooling device) from starting up undesirably. For example, if the heating is not to start in certain situations, e.g. when the window is open, the lock object can be used to lock the control value. Another application of the lock object is, for example, manual locking, e.g. via a push-button, in the event of a cleaning process. The lock object locks the control value as soon as a "1" is sent to the associated 1-bit communication object.

The following communication objects are available for this:

Number	Name	Length	Usage
14	Heating disable object	1 Bit	Locks the control value heating
15	Cooling disable object	1 Bit	Locks the control value cooling

Table 26: Communication objects – Lock objects

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4.4.5 Heating/Cooling request objects

The following picture shows the available settings:

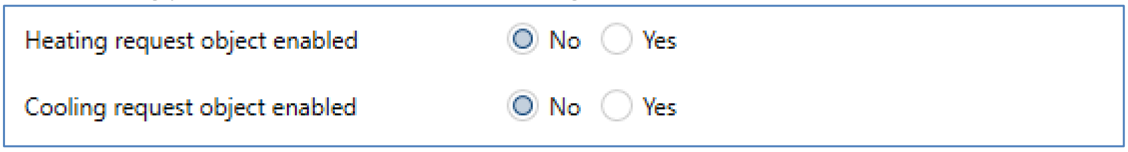

Figure 14: Settings – Heating/Cooling request objects

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Heating request object enabled	▪ **No** ▪ Yes	Activates the communication object for the visualization of a beginning heating process.
Cooling request object enabled	▪ **No** ▪ Yes	Activates the communication object for the visualization of a beginning cooling process.

Table 27: Settings –Heating/Cooling request objects

With this setting, two objects are shown, which indicates a beginning heating or cooling process. These objects are status objects.

The objects can be used for visualisation, for example. For example, a red LED could indicate an ongoing heating process and a blue LED an ongoing cooling process. Another application is the central switching on of a heating or cooling process. For example, it can be realised via an additional logic that all heaters of a building/area switch on as soon as a controller issues the request for heating. The object outputs a "1" as long as the process continues. When the process is finished, a "0" is output.

The following chart shows the relevant communication objects:

Number	Name	Length	Usage
17	Heating request	1 Bit	Indicates a beginning heating process
18	Cooling request	1 Bit	Indicates a beginning cooling process

Table 28: Communication objects – Heating/cooling request

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4.4.6 Guiding

The following picture shows the available settings:

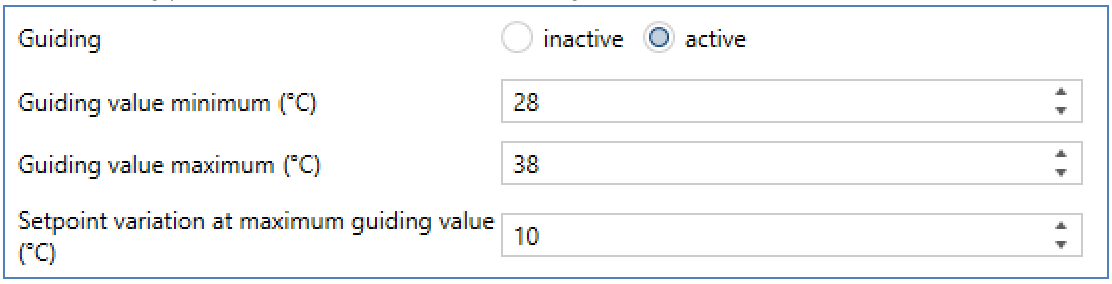

Figure 15: Settings – Guiding

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Guiding	▪ **inactive** ▪ active	Activates/deactivates the guiding.
Guiding value minimum (in °C)	-100°C … 100°C **[28 °C]**	Minimum value of the guiding.
Guiding value maximum (in °C)	-100°C … 100°C **[38 °C]**	Maximum value of the guiding.
Setpoint variation at maximum guiding value (in °C)	-100°C … 100°C **[10 °C]**	Setpoint offset at achievement of the maximum guiding value.

Table 29: Settings – Guiding

The parameter guiding causes a linear reposition of the control value in dependence of a guiding value, which is measured by an external sensor. With appropriated parameterization a continuous increment or decrement of the control value can be caused.
For adjusting how the guiding shall impact to the control value, three settings are necessary: Guiding value minimum (w_{min}), guiding value maximum (w_{max}), and setpoint variation at maximum guiding value ($\triangle X$).
The settings for the guiding value maximum (w_{max}) and minimum (w_{min}) describe the range of temperature in which the guiding starts and ends having impact to the setpoint. The real setpoint offset indicates the following formula:

$$\triangle X = \triangle X_{max} * [(w - w_{min})/(w_{max} - w_{min})]$$

If the guiding shall cause an increment of the setpoint, you must adjust a positive value for the setting "Setpoint variation at maximum guiding value". If you wish a decrement of the setpoint, you must choose negative value for the setting "Setpoint variation at maximum guiding value".
The variation of the setpoint $\triangle X$ is added to the basic comfort setpoint.
A measured temperature value for the guiding above the adjusted maximum value or below the adjusted minimum value has no effect to the setpoint.
So when the value is between the adjusted guiding values (w_{max} & w_{min}) the setpoint is increased or decreased.

The following diagrams shall illustrate the connection between guiding and setpoint:
(Xsetpoint=new setpoint; Xbasic=basic comfort setpoint)

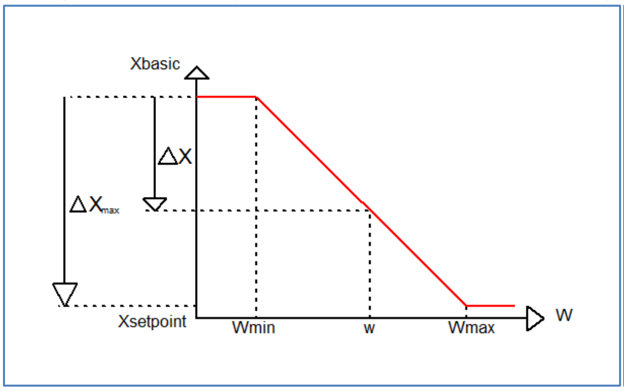

Figure 16: Example – Guiding decrement

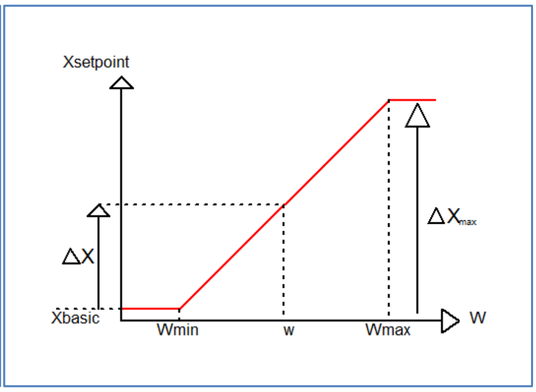

Figure 17: Example – Guiding increment

The communication object for the guiding value must be connected to the external measured temperature. Through this object, the guiding becomes the reference value for the guiding process.

The following communication object is available for this:

Number	Name	Length	Usage
20	Guiding value	2 Byte	Receiving of the reference temperature for the guiding

Table 30: Communication object – Guiding

Example for the usage:
For the temperature regulation of a room, the setpoint (22°C) shall be increased in a way that at a measured outside temperature range of 28°C to 38°C, the difference of the temperature outside and inside is never more than 6K.

The following settings must be done at the controller:
Basics Comfort setpoint: 22°C
Guiding: active
Guising value minimum: 28°C
Guiding value maximum: 38°C
Setpoint variation at maximum guiding value: 10°C

If the temperature outside increase to value of 32°C now, the setpoint will be increased by the following value:
△X = 10°C * [(32°C - 28°C)/(38°C - 28°C)] = 4°C

So we would have a new setpoint of 22°C + 4°C = 26°C.
If the outside temperature reaches the adjusted maximum of 38°C, the setpoint will be 32°C and behave this value even if the temperature would continue to rise.

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4.4.7 Dead zone

The following picture shows the available settings:

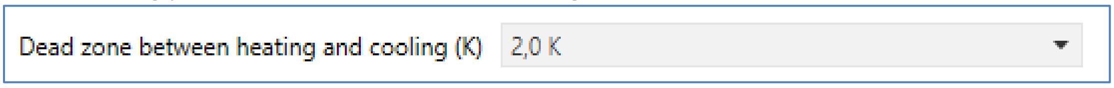

Figure 18: Settings – Dead zone

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Dead zone between heating and cooling (K)	1,0 K – 10,0 K **[2,0 K]**	Setting range for the dead zone.

Table 31: Settings – Dead zone

These settings are only available when the controller type is set to “Heating and Cooling”.
The dead zone is the area in which the controller does not activate either the heating or the cooling process. Consequently, the controller does not send a value to the control value in the range of the dead zone and thus the control value remains switched off. When setting the dead zone, it should be noted that a smaller value leads to frequent switching between Heating and Cooling, but a high value leads to a large fluctuation of the actual room temperature.
If the controller is set to "Heating and Cooling", the basic comfort value always forms the setpoint for the heating process. **The setpoint for the cooling process results from the addition of the basic Comfort value and the dead zone**. A basic comfort value of 21°C and a dead zone of 3K result in a setpoint of 21°C for "Heating" and a setpoint of 24°C for "Cooling".
The dependent setpoints for "Heating and Cooling", i.e. those for the operating modes "Standby" and "Night", can be configured again independently of each other in the "Heating and Cooling" controller mode. The setpoints are then calculated as a function of the basic Comfort value, the setpoint of the "Comfort" operating mode, for the heating and the cooling process.
The setpoints for "Heat protection" and "Frost protection" are independent of the settings for the dead zone and the other setpoints.
The following illustration shows the correlations between dead zone and the setpoints for the single operating modes.
The following settings are made for this example:

Basic comfort setpoint: 21°C
Increase and Reduction Standby: 2K
Dead zone between heating and cooling: 3K
Increase and Reduction Night: 4K

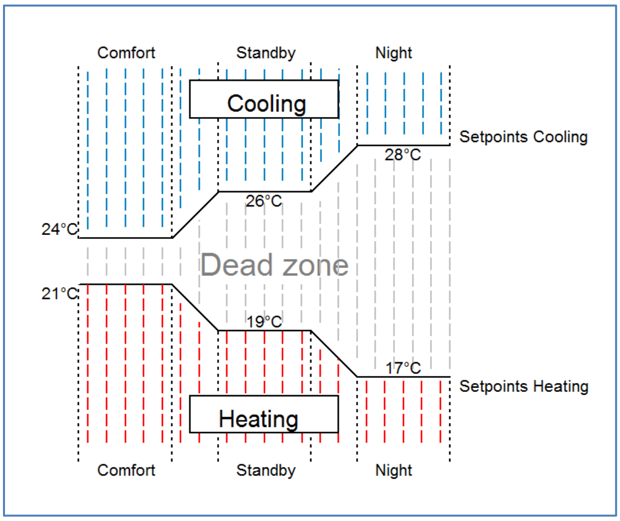

Figure 19: Example – Dead zone

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4.5 Controller settings

4.5.1 Control value

The following picture shows the available settings:

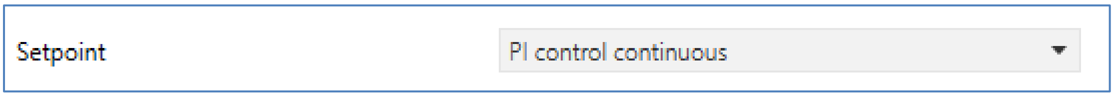

Figure 20: Settings – Control value

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Control value *Setpoint*	▪ **PI control continuous** ▪ PI control switching (PWM) ▪ 2-step control (switching)	The control variable defines the used control method.

Table 32: Settings – Control value

The controller contains of three different controlling methods, which control the control value. Further configuration options are dependent to the adjusted control method.

The following communication objects are available for this:

Number	Name	Length	Usage
8	Control value heating	1 Byte 1 Bit	Control of the actuator for the heating process. DPT depending on the set parameter.
8	Control value heating/cooling	1 Byte 1 Bit	Sending the control value for the heating and cooling process. DPT depending on the set parameter. Available for system "2 pipe / 1 circuit".
10	Control value cooling	1 Byte 1 Bit	Control of the actuator for the cooling process. DPT depending on the set parameter.

Table 33: Communication objects – Control value

According to the adjusted controller type the control value controls a heating and/or a cooling process. If the control value is chosen as PI control continuous, the communication objects will have the size of 1 Byte, because the object can assume several states. If the control value is chosen as PI control switching or 2-step control, the communication object will have the size of 1 Bit, because the communication object can only assume the states “ON” or “OFF”.

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4.5.2 PI control continuous

The following picture shows the available settings (here for controller type “Heating”):

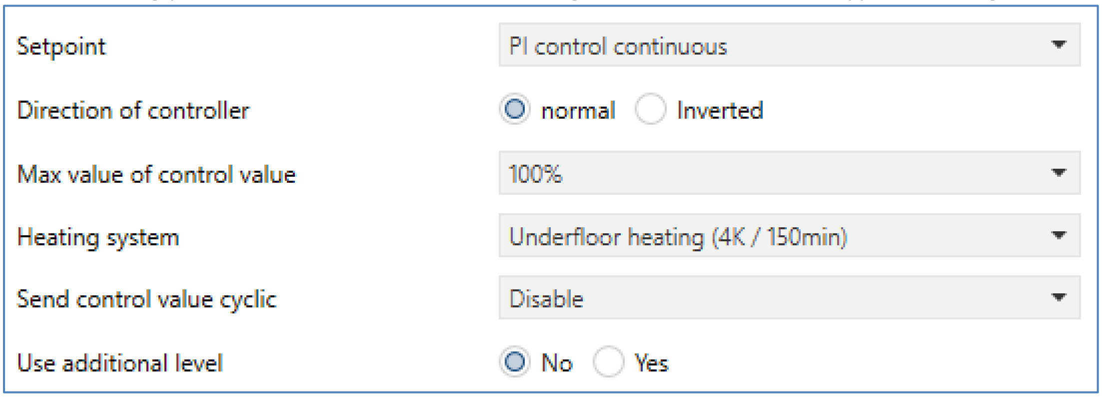

Figure 21: Settings – PI control continuous

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Defines the controlling behavior with rising temperature 4.5.5 Direction of controller.
Max value of control value	**100%**; 90%; 80%; 75%; 70%; 60%; 50%; 40%; 30%; 25%; 20%; 10%; 0%	Indicates the output power of the manipulated variable in maximum operation.
Heating system	▪ **Warm water heating (4K/120min)** ▪ Underfloor heating (4K/150min) ▪ Split Unit (4K/60min) ▪ Adjustment via control parameter	Setting of the used heating system. Individual configuration available via “Adjustment via control parameter”
Cooling system	▪ **Split Unit (4K/60min)** ▪ Cooling ceiling (4K/150min) ▪ Adjustment via control parameter	Setting of the used cooling system. Individual configuration available via “Adjustment via control parameter”
Proportional range (K)	1 K – 8 K **[2K]**	**With selection "Adjustment via control parameters"**. Free setting of the proportional range.
Reset time (min)	15 min – 210 min **[150 min]**	**With selection "Adjustment via control parameters"**. Free setting of the reset time.
Send control value cyclic	**Disable**, 1 min – 60 min	Activation of whether the control value is to be sent cyclically.
Use additional level	▪ **No** ▪ Yes	Activation of an additional control level possible. **Only available in “Heating” mode**

Table 34: Settings – PI control continuous

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The PI control continuous is a continuous controlling with proportional amount, the Proportional range, and an integral amount, the reset time. The size of the proportional range is indicated in “K” (Kelvin), whereas the I-amount is indicated in “minutes”.
The control value for continuous PI control is controlled in steps from 0% to the set maximum value of the control value.

Max value of control value
With this setting, it can be adjusted which maximum value the control value can assume. To prevent switching processes at large control values, a maximum can be defined by the setting “Max value of control value”. So the control value cannot exceed this value.

Heating/ cooling system
The control parameter (P-amount and I-amount) are adjusted by the setting for the used heating/ cooling system. You can use preset values, which fit to determined heating or cooling systems, or parameterize the proportional range and the reset time freely. The preset values for the corresponding heating or cooling system are based on empirical values and lead often to good controlling results.

By choosing “Adjustment via control parameter”, the proportional range and the reset time can be set freely.
Important: This setting requires a good knowledge in the field of control technology.

Proportional range
The proportional range describes the P-amount of the controlling. The P-amount produces a proportional increment to the deviation of the control value.
A small proportional range causes a short recovery time of the deviation. The controller reacts thereby almost immediately and sets the control value already at a small deviation almost to the maximum value (=100%). If the proportional range is chosen too small, the system will swing across.
A proportional range of 4K means a control deviation of 4°C causes a control value of 100%. So a control deviation of 1°C will cause a control value of 25%.

Reset time
The reset time describes the I-amount of the controlling. The I-amount of a controlling causes an integral convergence of the actual value to the setpoint. A short reset time indicates a strong I-amount.
A short reset time causes that the control value approaches fast to the control value, which is set by the proportional range. A big reset time causes a slow approach to this value.
To note is, that a reset time, which is adjusted too small, can cause across swinging. In principle you can say each carrier the system, each bigger the reset time.

Send control value cyclic
The parameter “Send control value cyclic” causes a cyclic sending of the actual control value. The time shifts between two values can be also configured.

Use additional level
Eine ausführliche Beschreibung zu diesem Parameter, siehe 4.5.6 Additional level

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4.5.3 PI control switching (PWM)

The following picture shows the available settings (here for controller type “Heating”):

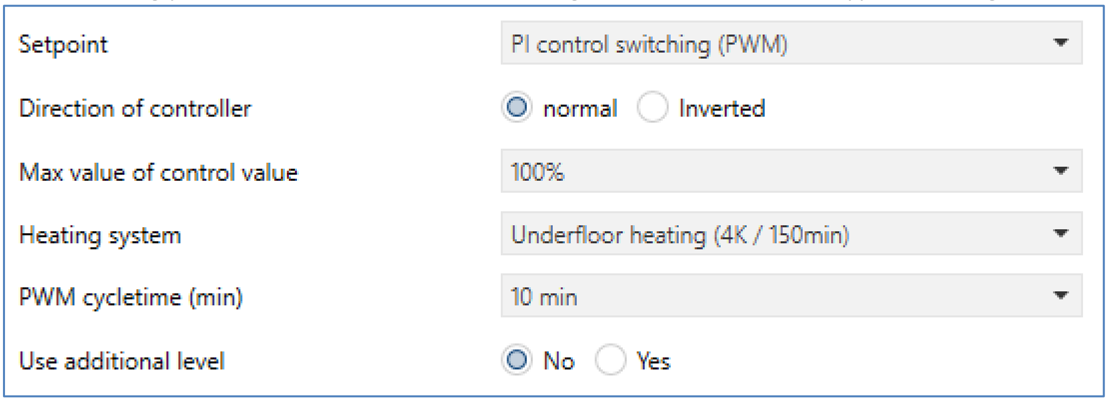

Figure 22: Settings – PI control switching (PWM)

The PI control switching is a development of the PI control continuous. All settings of the continuous control are also available at the PI control switching. Additionally, a PWM cycle time can be adjusted.

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Defines the controlling behaviour with rising temperature 4.5.5 Direction of controller.
Max value of control value	**100%**; 90%; 80%; 75%; 70%; 60%; 50%; 40%; 30%; 25%; 20%; 10%; 0%	Indicates the output power of the control value in maximum operation.
Heating system	▪ Warm water heating (4K/120min) ▪ **Underfloor heating (4K/150min)** ▪ Split Unit (4K/60min) ▪ Adjustment via control parameter	Setting of the used heating system. Individual configuration available via “Adjustment via control parameter”
Cooling system	▪ Split Unit (4K/60min) ▪ **Cooling ceiling (4K/150min)** ▪ Adjustment via control parameter	Setting of the used cooling system. Individual configuration available via “Adjustment via control parameter”
Proportional range (K)	1 K – 8 K **[2 K]**	**With selection "Adjustment via control parameters"**. Free setting of the proportional range.
Reset time (min)	15 min – 210 min **[150 min]**	**With selection "Adjustment via control parameters"**. Free setting of the reset time.
PWM cycle time (min)	5 min / **10 min /** 15 min / 20 min / 25 min / 30 min	Setting of the PWM cycle time. Includes the total time of a switch-on and switch-off pulse.
Use additional level	▪ **No** ▪ Yes	Activation of an additional control level possible. **Only shown in “Heating” mode**

Table 35: Settings – PI control switching (PWM)

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With PWM control, the controller switches the manipulated variable according to the value calculated during PI control, considering the cycle time. The manipulated variable is thus converted into a pulse-width modulation (PWM).

PWM cycle time
The „PWM cycle time“ serves the controlling for calculating the length of the on-pulse and the off-pulse. This calculation occurs at the base of the calculated continuous value in percent. One PWM cycle contains the time, which elapses from one switching on point to the other.

> **Example:** If a control value of 75% is calculated and a cycle time of 10min is adjusted, the control value will be switched on for 7,5min and switched off for 2,5min.

Basically, the following applies to the cycle time: the more sluggish the overall system, the greater the cycle time can be set.

Use additional level
Eine ausführliche Beschreibung zu diesem Parameter, siehe 4.5.6 Additional level

4.5.4 2-step control (switching)

The following picture shows the available settings (here for controller type “Heating”):

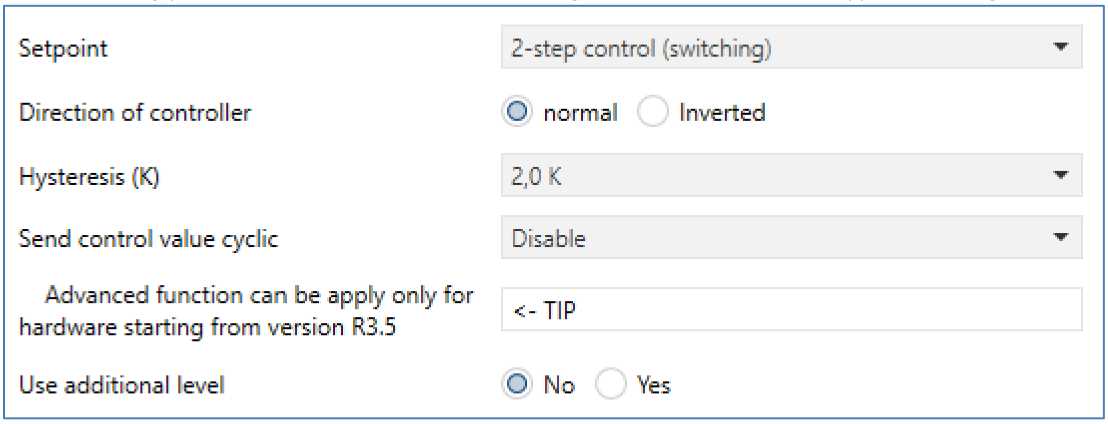

Figure 23: Settings – 2-step control (switching)

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Defines the controlling behaviour with rising temperature 4.5.5 Direction of controller.
Hysteresis (K)	0,5 K – 5,0 K **[2,0 K]**	Setting for upper and lower switch-on and switch-off point.
Send control value cyclic	**Disable**, 1 min – 60 min	Activation of whether the control value is to be sent cyclically.
Use additional level	▪ **No** ▪ Yes	Activation of an additional control level possible. **Only shown in “Heating” mode**

Table 36: Settings – 2-step control (switching)

The 2-point controller is the simplest type of control. Only the two states ON or OFF are sent to the control value. The controller switches the control value (e.g. heating process) on when the temperature falls below a certain target temperature and switches it off again when the temperature exceeds a certain target temperature. The switch-on and switch-off points, i.e. where the target temperature is located, depend on the currently set setpoint and the set switching hysteresis.
The 2-point controller is used when the control value can only assume two states, e.g. an electrothermal valve.

Hysteresis
The setting of the hysteresis is used for calculating the points of switching on and off. This occurs under consideration of the current adjusted setpoint.

> **Example:** A basic comfort value of 21°C and a hysteresis of 2K have been set in the controller in Heating mode. In Comfort mode, this results in a switch-on temperature of 20°C and a switch-off temperature of 22°C.

To note is that a big hysteresis generates big differences of the room temperature. A small hysteresis can generate an almost permanent switching process, because the points for switching on and off are very close to each other. This can generate a fast consumption of the control value.

Use additional level
Eine ausführliche Beschreibung zu diesem Parameter, siehe 4.5.6 Additional level

4.5.5 Direction of controller

The following picture shows the available settings:

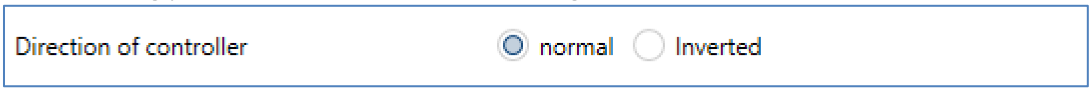

Figure 24: Settings – Direction of controller

The direction of the controller describes the behaviour of the control value by a changing of the control difference at rising temperature. The control value can react normal or inverted to a rising temperature. The direction of the controller can be adjusted for all control values (PI-control continuous, PI-control switching and 2-Step control).
An inverted control value is for adaption to normally opened valves at the 2-Step control and at the PI-control switching.
An inverted control value means for the single control values, by controller type heating, the following adjustments

- **PI-control continuous**
  The control value falls at raising regular difference and rises at falling regular difference.
- **PI-control switching**
  The ratio between duration of switching on to the whole PWM cycle time raise by falling temperature and falls by raising temperature.
- **2-Step control**
  The controller switches on at the normal point for switching off and switches off at the normal point for switching on.

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The following graphic shows the effects of the direction of action on the controller. All controllers are set to the control mode "Heating":

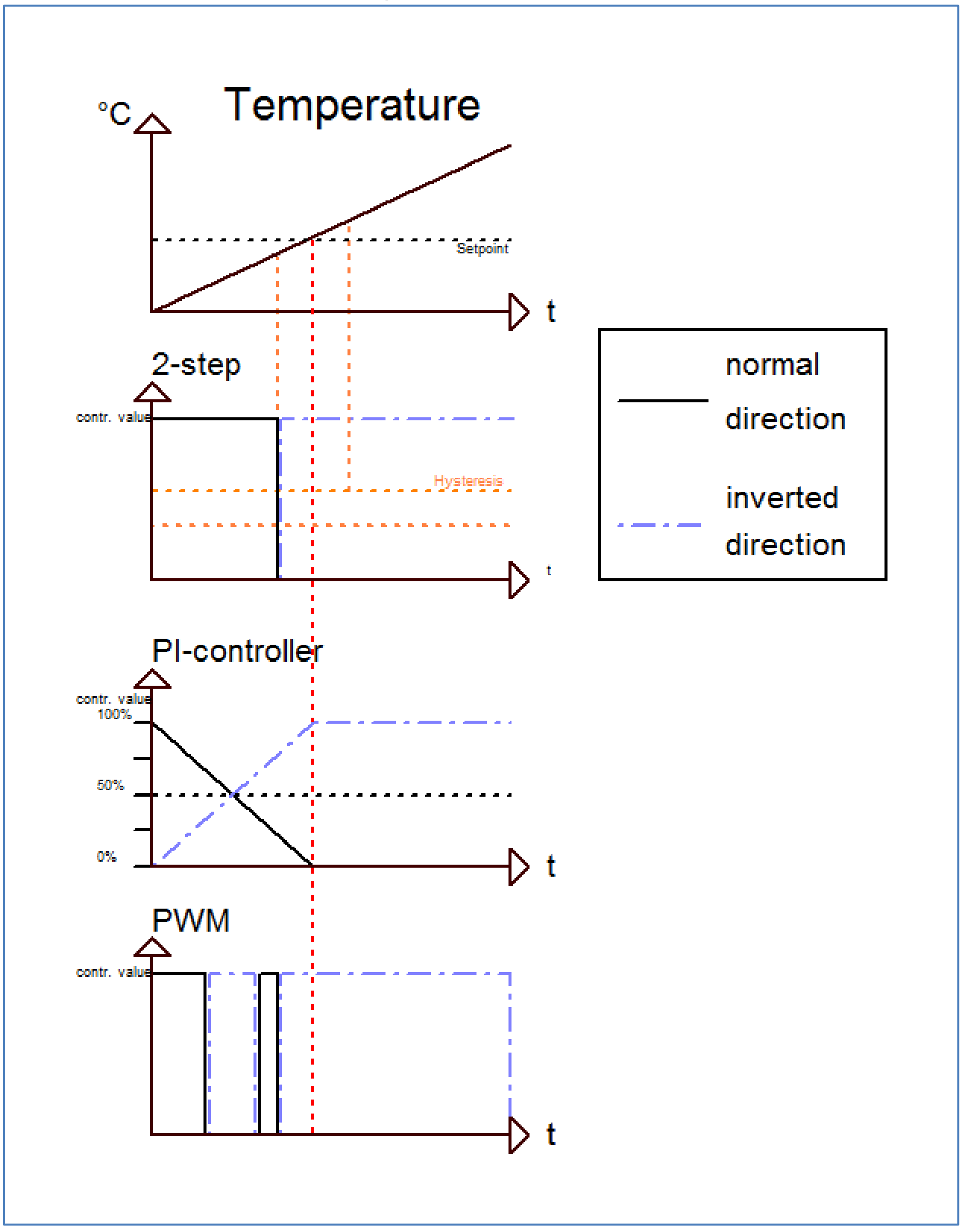

Figure 25: Graphic – Effects of the direction of action on the controller

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4.5.6 Additional level

The following picture shows the available settings:

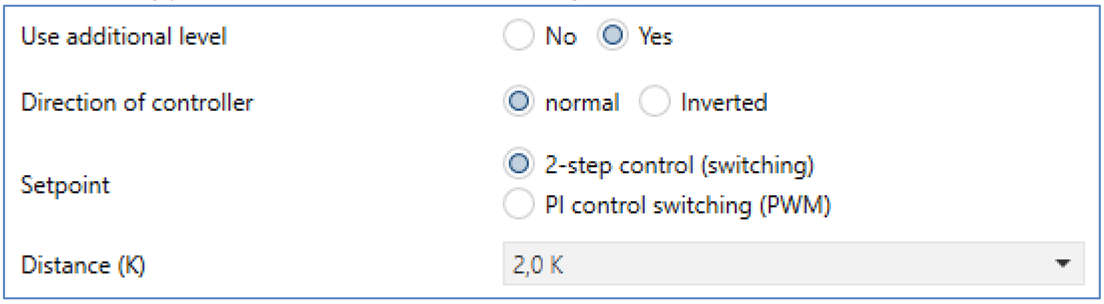

Figure 26: Settings – Additional level

The table shows the available settings (with activated additional level):

ETS-text	Dynamic range **[default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Defines the controlling behaviour with rising temperature 4.5.5 Direction of controller.
Control value	▪ **2-Step control (switching)** ▪ PI control switching (PWM)	Setting of the used control value.
Distance (in K)	1,0K – 10,0K [2,0K]	Distance between the setpoints of the normal controlling and the setpoint for the additional level.

Table 37: Settings – Additional level

The additional level can be used in sluggish systems to shorten the heating phase, e.g. in the case of underfloor heating, a radiator or an electric heater could be used as an additional level to shorten the longer heating phase of the sluggish underfloor heating.

The direction of action can also be set for the additional level, see 4.5.5 Direction of controller.
The distance in K describes the setpoint of the additional level. The adjusted distance is deducted from the setpoint of the basic level; the resulting value is the setpoint for the additional level.

The 2-point control and the PWM control are available to the user for setting the controller type/control value. The communication object of the additional stage is therefore always a 1-bit object and only switches the control value ON or OFF.

The setpoint for the additional stage can be configured with the distance (in K). The set distance is subtracted from the setpoint of the basic level, which then results in the setpoint for the additional level.

Example: The controller has the operating mode comfort, with the basic comfort setpoint of 21°C. The distance is adjusted as 2,0K. So the setpoint for the additional level is 21°C - 2,0K = 19,0°C.

The following communication object is available for this:

Number	Name	Length	Usage
9	Control value additional heating	1 Bit	control value for the additional level

Table 38: Communication object – Additional level

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4.5.7 Additional settings for “Heating & Cooling” mode

The following picture shows the available settings (Controller type is “heating and cooling”):

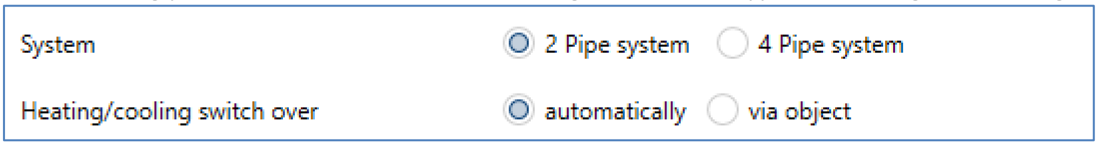

Figure 27: Settings – Heating & Cooling

The table shows the available settings:

ETS-text	Dynamic range **[default value]**	Comment
System	▪ **2 Pipe system** ▪ 4 Pipe system	Setting for combined or divided heating and cooling circuits.
Heating/cooling switch over	▪ **automatically** ▪ via object	Setting whether the changeover is carried out automatically via the temperature or via a separate object.

Table 39: Settings – Heating & Cooling

The system used can be selected via the "**System**" setting. If there is a common system for the cooling & heating process, the setting 2 pipe/1 circuit is to be selected. If the cooling process and heating process are controlled by two individual units, the setting 4 pipe/2 circuit is to be selected. With the setting “**Switchover Heating/Cooling**” it is also possible to select between manual switching between “Heating” and “Cooling” via an object and automatically via the temperature.

2 Pipe system
In a common pipe system for the heating and cooling process, there is only one communication object that controls the control value. The change from “Heating” to “Cooling” or from “Cooling to Heating” is made by a changeover. This can also be used simultaneously for changing between heating and cooling medium in the system. This ensures, for example, that warm water flows in a heating/cooling ceiling during “Heating” and cold water during “Cooling”. In this case only one common controller (PI, PWM or 2-point) can be selected for the control value. The direction of action can also only be defined identically for both processes. However, the individual control parameters for the selected controller can be parameterized independently of each other.

4 Pipe system
If there is a separate pipe system for the heating and cooling process, both processes can also be parameterized separately. Consequently, separate communication objects exist for both control values. This makes it possible to control the heating process e.g. via a PI control and the cooling process e.g. via a 2-step control, as both processes can be controlled by different devices. For each of the two individual processes, completely individual settings for the control value and the heating/cooling system are therefore possible.

Switchover Heating/Cooling

By the setting "heating/cooling switch over" it is possible to adjust whether the controller shall switch automatically or via communication object. At the automatic switchover, the controller evaluates the setpoints and knows because of the adjusted setpoints in which mode the controller is at the moment. When the controller heated before, the controller switches over when the measured temperature rises over the adjusted setpoint for cooling. As long as the controller is at the dead zone between heating and cooling, the heating process remains set, but does not heat as long as the temperature is above the adjusted setpoint for heating.
By choosing the switchover via object, an additional communication object is shown. By this object the switchover can be done. The controller stays as long at the adjusted operating mode until it becomes a signal via the according communication object. As long as the controller is at the heating mode only the setpoint for the heating is watched, also if the controller is, according to its setpoints, already at the cooling mode. A start of the cooling mode is also only possible, when the controller becomes a signal via the communication object.
A "0" switches the cooling process on and a "1" switches the heating process on.

The following communication object is available for this:

Number	Name	Length	Usage
19	Heating/Cooling switchover – 0=Cooling 1=Heating	1 Bit	Switchover between Heating and Cooling

Table 40: Communication object – Heating/Cooling switchover

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5 Index

5.1 Register of Illustrations

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5.2 List of tables

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6 Appendix

6.1 Statutory requirements

The above-described devices must not be used with devices, which serve directly or indirectly the purpose of human, health- or lifesaving. Further the devices must not be used if their usage can occur danger for humans, animals or material assets.
Do not let the packaging lying around careless, plastic foil/ -bags etc. can be a dangerous toy for kids.

6.2 Disposal

Do not dispose of the old devices in the household waste. The device contains electrical components that must be disposed of as electronic waste. The housing is made of recyclable plastic.

6.3 Assembly

Danger to life from electric current!

The device may only be installed and connected by qualified electricians. Observe the country-specific regulations and the applicable KNX guidelines

The units are approved for operation in the EU and bear the CE mark. Use in the USA and Canada is not permitted!

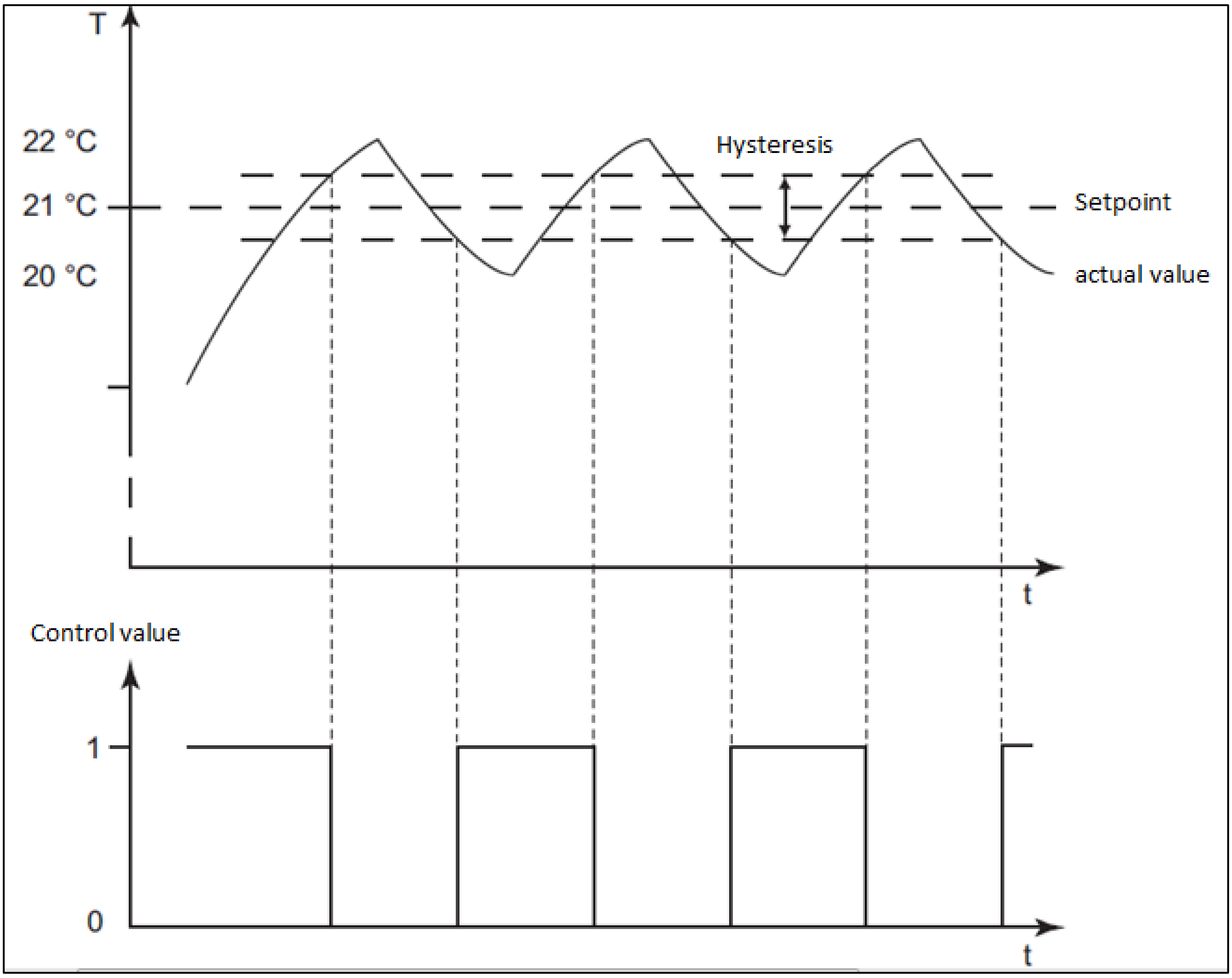
6.4 History

V1.0	First version of the Technical Manual		12/2014
V1.1	Adjustments, general corrections	DB V1.4	11/2022

6.5 Controller types

Three different controller types can be chosen for the control value. These controller types are described for the heating process by the following illustrations.

6.5.1 2-Step control



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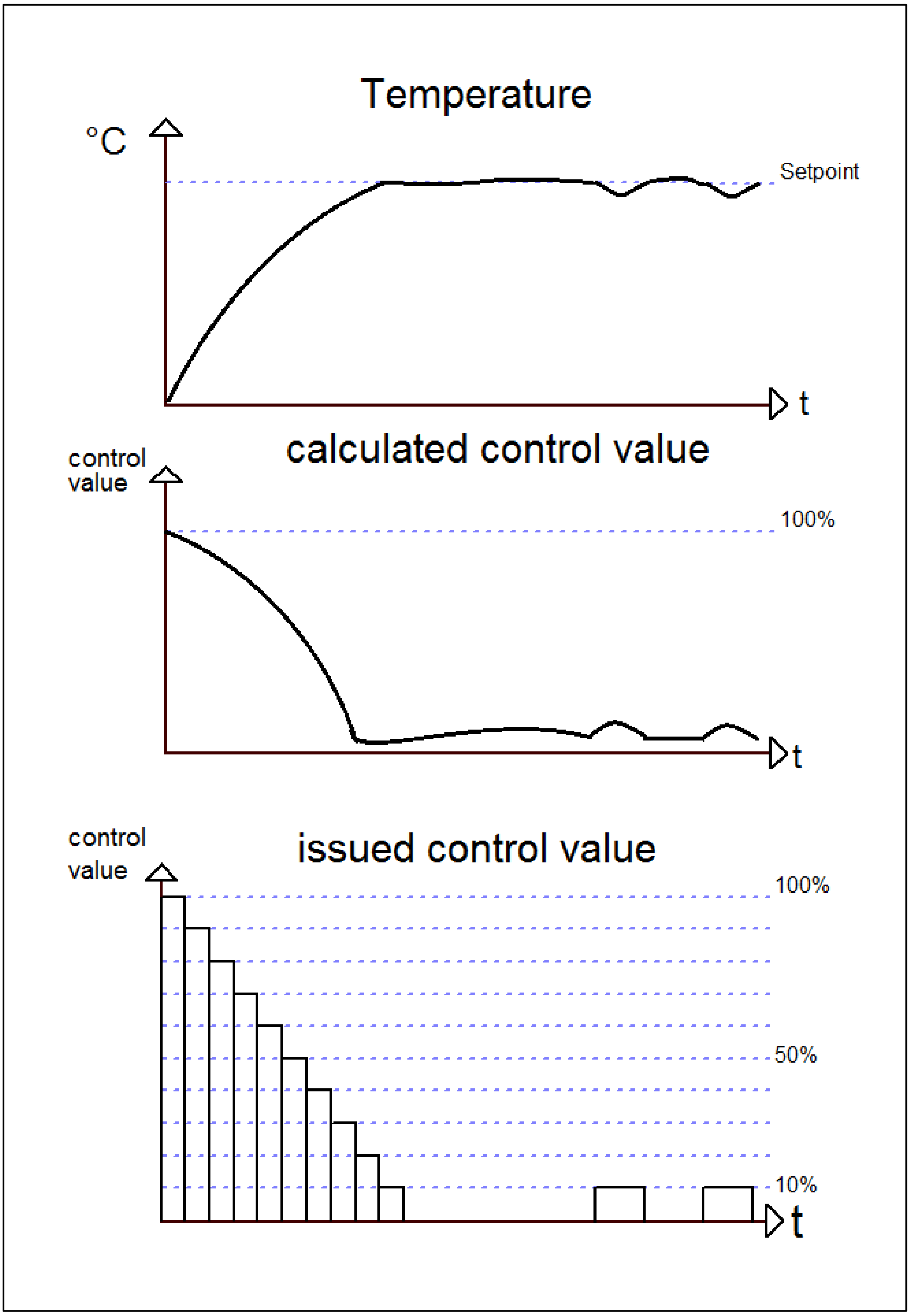
6.5.2 PI-control continuous



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6.5.3 PI-control switching (PWM)