State 06/2022 Version V1.0

Technical Manual

MDT CO2 / VOC Combi Sensor 55

SCN-CO2MGS.02

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

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1 Content

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2 Overview

2.1 Overview devices

The description refers to the following devices (order number in bold):

- **SCN-CO2MGS.02** CO2 / VOC Combi Sensor 55, white glossy finish
  - Combined sensor for measuring the CO2 and the mixed gas concentration (VOC), room temperature and relative humidity
  - Air quality control function adjustable as step / PI controller for CO2 or VOC sensor
  - Air quality traffic light function, adjustable to CO2 or VOC sensor, with 3 or 4 traffic light levels and optionally with 1 bit / scene / RGB or HSV output objects
  - Integrated room temperature controller

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2.2 Special functions

Environment measuring channels
In addition to the measuring channels for CO2 and VOC, the combi-sensor also records the room temperature and relative humidity. With these measured values, it can control temperature and air quality. The air quality traffic light alerts you to excessive CO2 or VOC concentrations in the room. VOC is the abbreviation for *volatile organic compounds*, which can be produced during evaporation at room temperature and impair the quality of the room air.

Air quality traffic light
The output of the air quality traffic light can be set as [1 bit] step-, scene-, RGB- or HSV-objects. For example, the lighting colour can change automatically and remind you to ventilate the room. The CO2 or VOC value can be used as input variable. The threshold values of the air quality traffic light are freely adjustable in [ppm] "parts per million" – or in the case of VOC, alternatively as [IAQ] "Indoor Air Quality" Index. The hysteresis between the traffic light levels can be applied in [percent], [ppm] or [IAQ]. The IAQ index from 0 to 500 provides general information about the quality of indoor air, which has an impact on people's well-being.

Air quality controller
The air quality control can be activated as a step switch (bit-, binary-, byte-coded) or as PI control. The measured value for the control can be both the CO2 and the VOC value - in each case in combination with the relative humidity. Used as central ventilation control, up to 10 external sensors can be integrated into the regulation via communication objects. A wide range of adjustment options allows you to adapt the air quality control to your own needs. For example, the hysteresis of the step controller, or the reset time and proportional coefficient of the PI control can be adjusted. The setpoints or ventilation levels can be different for day and night. The air quality control can be overridden at any time via the adjustable lock object.

Room temperature controller
The actual temperature of the internal or an external temperature sensor is sufficient for the PI controller to start the regulation. The setpoints for "Comfort", "Standby" and "Night" can be individually configured independently of the "Basic Comfort" setpoint. This ensures a high level of compatibility with many visualisations. The setpoint shift can be done classically via 1 bit (step), 1 byte (counting pulses) and via
2 bytes (temperature difference and absolute values). This also provides a high degree of compatibility with a wide variety of visualisations. Set values and the operating mode can be saved and restored in the event of a bus voltage failure.
To shorten the heating phases, the temperature controller has an additional heating level- optionally as a 2-point control or as PWM (switching PI control).
The CO2 / VOC Combi Sensor has a plain text diagnosis and outputs the status of the temperature controller via a 14-byte object. This allows errors to be localised in a short time and makes commissioning much easier for the system integrator.

Long Frame Support
Support of sending longer telegrams and thus the integration of more user data per telegram. This significantly shortens the programming time.

Updateable via DCA
With the help of the MDT Update Tool, the devices can be updated if necessary. The download is available free of charge at www.mdt.de and www.knx.org.

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2.3 Exemplary Circuit Diagram

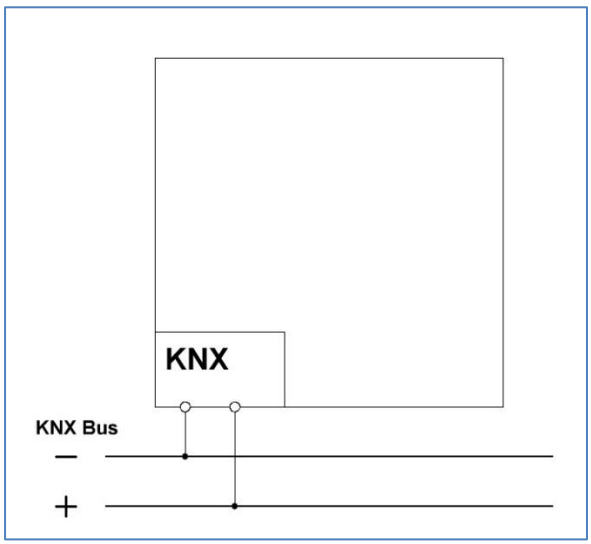

Figure 1: Exemplary circuit diagram

2.4 Structure & Handling

The following picture shows the structure of the device:

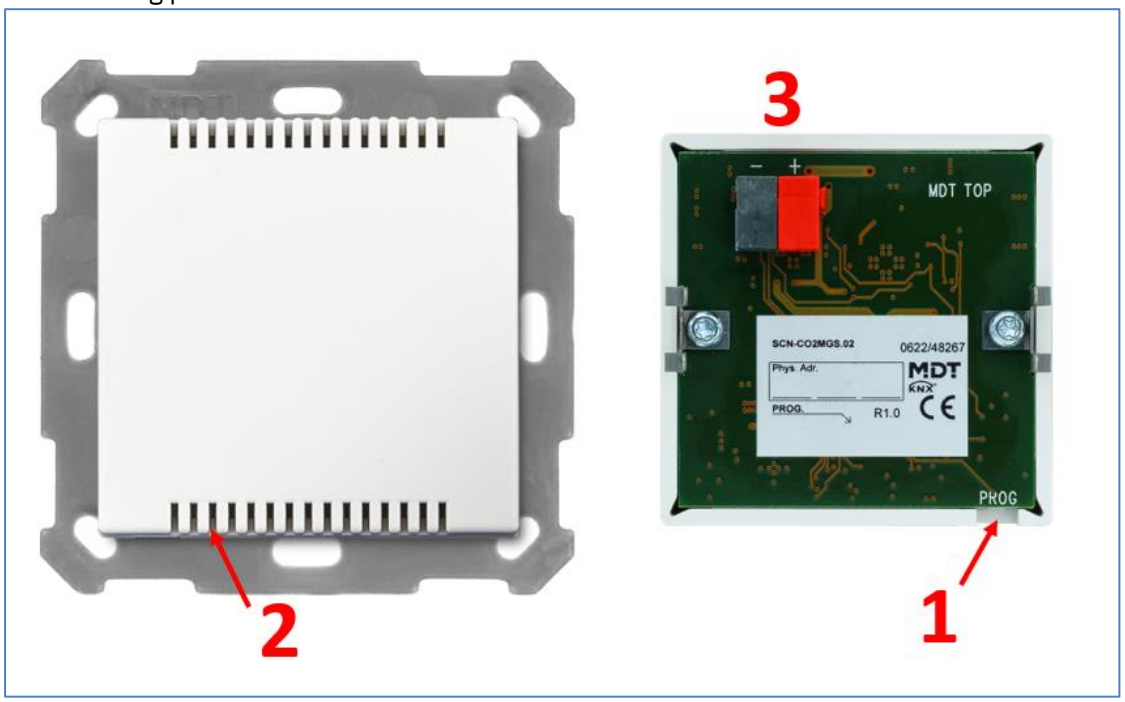

Figure 2: Structure & Handling

1 = Programming button (on the side of the unit)
2 = Programming LED in the unit (visible through slots in the housing)
3 = Bus connection terminal

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2.5 Commissioning

After wiring the unit, the physical address is assigned, and the application is programmed:

(1) Connect the programming interface with the bus, e.g. with MDT USB Interface.
(2) Switch-on bus voltage.
(3) Press the programming button on the side of the unit (red programming LED lights up).
(4) Loading the physical address from the ETS software via the interface (red LED goes out as soon as this has been successfully completed).
(5) Loading the application, with desired parameterization.
(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 Standard settings of the communication objects

Standard settings - Environment measuring channels								
No.	**Name**	**Object function**	**Length**	**C**	**R**	**W**	**T**	**U**
1	CO2 measurement	Send measured value	2 Byte	X	X		X	
2	CO2 measurement	External sensor input	2 Byte	X		X	X	X
3	CO2 measurement	Maximum value exceeded	1 Bit	X	X		X	
4	CO2 measurement	Minimum value fallen below	1 Bit	X	X		X	
5	CO2 measurement	Error external sensor	1 Bit	X	X		X	
8	VOC measurement	Send measured value	2 Byte	X	X		X	
9	VOC measurement	External sensor input	2 Byte	X		X	X	X
10	VOC measurement	Maximum value exceeded	1 Bit	X	X		X	
11	VOC measurement	Minimum value fallen below	1 Bit	X	X		X	
12	VOC measurement	Error external sensor	1 Bit	X	X		X	
15	Temperature measurement	Send measured value	2 Byte	X	X		X	
16	Temperature measurement	External sensor input	2 Byte	X		X	X	X
17	Temperature measurement	Maximum value exceeded	1 Bit	X	X		X	
18	Temperature measurement	Minimum value fallen below	1 Bit	X	X		X	
19	Temperature measurement	Error external sensor	1 Bit	X	X		X	
22	Relative humidity measurement	Send measured value	2 Byte	X	X		X	
23	Relative humidity measurement	External sensor input	2 Byte	X		X	X	X
24	Relative humidity measurement	Maximum value exceeded	1 Bit	X	X		X	
25	Relative humidity measurement	Minimum value fallen below	1 Bit	X	X		X	
26	Relative humidity measurement	Error external sensor	1 Bit	X	X		X	

Table 1: Communication objects – Environment measuring channels

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Standard settings - Air quality functions								
No.	**Name**	**Object function**	**Length**	**C**	**R**	**W**	**T**	**U**
29	Air quality traffic light	Output level 1	1 Bit	X	X		X	
30	Air quality traffic light	Output level 2	1 Bit	X	X		X	
31	Air quality traffic light	Output level 3	1 Bit	X	X		X	
32	Air quality traffic light	Output level 4	1 Bit	X	X		X	
33	Air quality traffic light	Output RGB	3 Byte	X	X		X	
33	Air quality traffic light	Output HSV	3 Byte	X	X		X	
34	Air quality traffic light	Output Scene	1 Byte	X	X		X	
37	Air quality controller	Preset setpoint	2 Byte	X		X		
38	Air quality controller	Actual setpoint	2 Byte	X	X		X	
39	Air quality controller	CO2 Input 1	2 Byte	X		X		
39	Air quality controller	VOC Input 1	2 Byte	X		X		
39	Air quality controller	VOC (IAQ Index) Input 1	2 Byte	X		X		
40	Air quality controller	CO2 Input 2	2 Byte	X		X		
40	Air quality controller	VOC Input 2	2 Byte	X		X		
40	Air quality controller	VOC (IAQ Index) Input 2	2 Byte	X		X		
41	Air quality controller	CO2 Input 3	2 Byte	X		X		
41	Air quality controller	VOC Input 3	2 Byte	X		X		
41	Air quality controller	VOC (IAQ Index) Input 3	2 Byte	X		X		
42	Air quality controller	CO2 Input 4	2 Byte	X		X		
42	Air quality controller	VOC Input 4	2 Byte	X		X		
42	Air quality controller	VOC (IAQ Index) Input 4	2 Byte	X		X		
43	Air quality controller	CO2 Input 5	2 Byte	X		X		
43	Air quality controller	VOC Input 5	2 Byte	X		X		
43	Air quality controller	VOC (IAQ Index) Input 5	2 Byte	X		X		
44	Air quality controller	CO2 Input 6	2 Byte	X		X		
44	Air quality controller	VOC Input 6	2 Byte	X		X		
44	Air quality controller	Humidity Input 1	2 Byte	X		X		
44	Air quality controller	VOC (IAQ Index) Input 6	2 Byte	X		X		
45	Air quality controller	CO2 Input 7	2 Byte	X		X		
45	Air quality controller	VOC Input 7	2 Byte	X		X		
45	Air quality controller	Humidity Input 2	2 Byte	X		X		
45	Air quality controller	VOC (IAQ Index) Input 7	2 Byte	X		X		
46	Air quality controller	CO2 Input 8	2 Byte	X		X		
46	Air quality controller	VOC Input 8	2 Byte	X		X		
46	Air quality controller	Humidity Input 3	2 Byte	X		X		
46	Air quality controller	VOC (IAQ Index) Input 8	2 Byte	X		X		
47	Air quality controller	CO2 Input 9	2 Byte	X		X		
47	Air quality controller	VOC Input 9	2 Byte	X		X		
47	Air quality controller	Humidity Input 4	2 Byte	X		X		
47	Air quality controller	VOC (IAQ Index) Input 9	2 Byte	X		X		
48	Air quality controller	CO2 Input 10	2 Byte	X		X		

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48	Air quality controller	VOC Input 10	2 Byte	X		X		
48	Air quality controller	Humidity Input 5	2 Byte	X		X		
48	Air quality controller	VOC (IAQ Index) Input 10	2 Byte	X		X		
51	Air quality controller	Lock controller	1 Bit	X		X		
52	Air quality controller	Output control value	1 Byte	X	X		X	
53	Air quality controller	Output level 1	1 Bit	X	X		X	
54	Air quality controller	Output level 2	1 Bit	X	X		X	
55	Air quality controller	Output level 3	1 Bit	X	X		X	
56	Air quality controller	Output level 4	1 Bit	X	X		X	
58	Air quality controller	Override level	1 Byte	X		X		
58	Air quality controller	Override control value	1 Byte	X		X		

Table 2: Communication objects – Air quality functions

Standard settings – Temperature controller								
No.	**Name**	**Object function**	**Length**	**C**	**R**	**W**	**T**	**U**
61	Temperature controller	Preset setpoint	2 Byte	X		X		
62	Temperature controller	Preset Comfort setpoint	2 Byte	X		X		
62	Temperature controller	Preset (Basic) Comfort setpoint	2 Byte	X		X		
62	Temperature controller	Combination object (Heating): Preset setpoint	8 Byte	X		X		
62	Temperature controller	Combination object: Preset setpoint	8 Byte	X		X		
63	Temperature controller	Preset Standby setpoint	2 Byte	X		X		
64	Temperature controller	Preset Night setpoint	1 Byte	X		X		
65	Temperature controller	Preset Heat protection setpoint	2 Byte	X		X		
65	Temperature controller	Preset Frost protection setpoint	1 Byte	X	X		X	
66	Temperature controller	Combination object (Cooling): Preset setpoint	1 Bit	X			X	
67	Temperature controller	Send current setpoint	1 Bit	X	X	X	X	
68	Temperature controller	Manual setpoint shift (2 Byte)	1 Bit	X			X	
69	Temperature controller	Manual setpoint shift (1 Byte)	2 Byte	X			X	
69	Temperature controller	Manual setpoint shift (1=+ / 0=-)	2 Byte	X			X	
70	Temperature controller	Send status setpoint shift	2 Byte	X			X	
71	Temperature controller	Control value Heating: Send control value	1 Byte	X	X		X	
71	Temperature controller	Control value Heating: Send control value	1 Bit	X	X		X	
71	Temperature controller	Control value Heating/Cooling: Send control value	1 Byte	X	X		X	
71	Temperature controller	Control value Heating/Cooling: Send control value	1 Bit	X	X		X	
72	Temperature controller	Control value Cooling: Send control value	1 Byte	X		X	X	X
72	Temperature controller	Control value Cooling: Send control value	1 Bit	X			X	

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73	Temperature controller	Control value Heating: Send status	1 Bit	X			X	
73	Temperature controller	Control value Heating/Cooling: Send status	1 Byte	X	X		X	
74	Temperature controller	Control value Cooling: Send status	1 Byte	X	X		X	
75	Temperature controller	Additional level: Send control value Heating	1 Bit	X	X		X	
76	Temperature controller	Mode selection	1 Byte	X	X		X	
77	Temperature controller	Comfort operating mode: Comfort extension	1 Bit	X	X		X	
78	Temperature controller	Comfort mode	1 Bit	X		X		
79	Temperature controller	Night mode	1 Bit	X		X		
80	Temperature controller	Mode Frost protection	1 Bit	X		X		
80	Temperature controller	Mode Heat protection	1 Bit	X		X		
80	Temperature controller	Mode Frost/Heat protection	1 Bit	X		X		
81	Temperature controller	DPT_HVAC Mode: Send controller status	1 Byte	X	X		X	
81	Temperature controller	DPT_HVAC Status: Send controller status	1 Byte	X	X		X	
82	Temperature controller	DPT_HVAC Mode: Send controller status	1 Byte	X	X		X	
82	Temperature controller	DPT_HVAC Status: Send controller status	1 Byte	X	X		X	
82	Temperature controller	RHCC Status: Send controller status	2 Byte	X	X		X	
82	Temperature controller	DPT_RTC combined Status: Send controller status	2 Byte	X	X		X	
82	Temperature controller	DPT_RTSM combined Status: Send controller status	1 Byte	X	X		X	
83	Temperature controller	Send Frost alarm	1 Bit	X	X		X	
84	Temperature controller	Send Heat alarm	1 Bit	X	X		X	
85	Temperature controller	Receive flow temperature Heating	2 Byte	X	X		X	
87	Temperature controller	Diagnosis status	14 Byte	X	X		X	
88	Temperature controller	Window contact: 0=closed / 1=open	1 Bit	X		X	X	X
88	Temperature controller	Window contact: 1=closed / 0=open	1 Bit	X		X	X	X
89	Temperature controller	Lock object Heating: Lock control value	1 Bit	X	X	X	X	X
90	Temperature controller	Lock object Cooling: Lock control value	1 Bit	X	X	X	X	X
93	Temperature controller	Switchover: 1=Heating / 0=Cooling	1 Bit	X		X		
94	Temperature controller	Status: 1=Heating / 0=Cooling	1 Bit	X	X		X	
95	Temperature controller	Send Heating request	1 Bit	X	X		X	
96	Temperature controller	Send Cooling request	1 Bit	X	X		X	
97	Outside temperature	Receive measured value/reference value	2 Byte	X		X		

Table 3: Communication objects – Temperature controller

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Standard settings – General objects								
No.	**Name**	**Object function**	**Length**	**C**	**R**	**W**	**T**	**U**
57	Day/Night	Day = 1 / Night = 0	1 Bit	X		X	X	X
57	Day/Night	Night = 1 / Day = 0	1 Bit	X		X	X	X
100	Operating	Output	1 Bit	X	X		X	

Table 4: Communication objects – General objects

The table above shows the preset default settings. The priority of the individual communications objects and the flags can be adjusted by the user as required. The flags assign the communication objects their respective tasks in programming, where C stands 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 General Settings

The following figure shows the menu for the general settings:

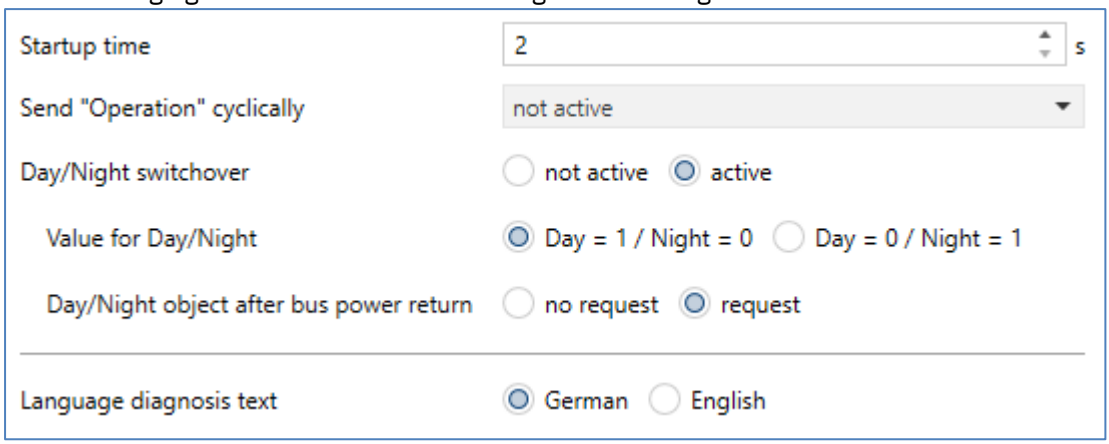

Figure 3: General settings

The following table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Startup time	2 ... 240 s **[2 s]**	Sets the time between restart and functional start-up of the device.
Send „Operation“ cyclically	**not active** 1 min – 24 h	Activation of a cyclic "in operation" telegram.
Day/Night switchover	▪ not active ▪ **active**	Activation/deactivation of a "Day/Night" object.
Value for Day/Night	▪ **Day = 1 / Night = 0** ▪ Day = 0 / Night = 1	Sets the polarity for the Day/Night object.
Day/Night object after bus power return	▪ no request ▪ **request**	Setting whether the object is to be automatically requested when the bus voltage returns.
Language diagnosis text	▪ **German** ▪ English	Setting the language of the diagnosis text.

Table 5: General settings

Startup time
This time defines when the unit "boots up" after a restart (reset, reprogramming, bus voltage recovery). 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.

„Operation“
"In operation" is used to show on the bus that the unit is "alive". If activated, an ON telegram is sent cyclically.

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Day/Night switchover:
By activating the "Day/Night" object, the polarity for Day/Night can be defined in the following. Regardless of this polarity, the unit always starts in "Day"-mode after reprogramming. Furthermore, it can be defined whether the object is to be actively queried after a bus voltage recovery.

Language diagnosis text
The language in which the diagnostic text is output is set here.

The table shows the general communications objects:

Number	Name/Object function	Length	Usage
57	Day / Night	1 Bit	Input of the value, whether "Day" or "Night"
100	Operating – Output	1 Bit	Sending a cyclic "In operation" telegram

Table 6: General communication objects

4.2 Environment measuring channels

The following settings are available for this menu:

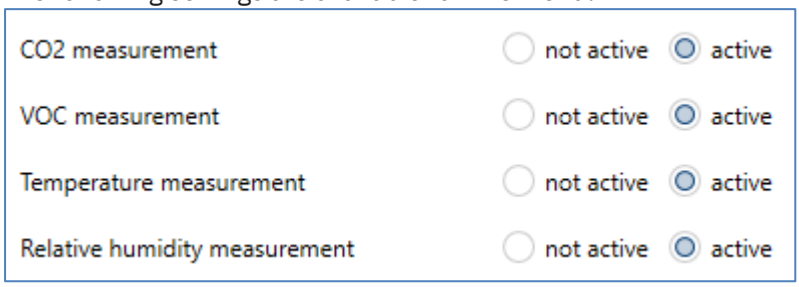

Figure 4: Settings – Environment measuring channels

Depending on the activation of the different measuring channels, a submenu appears under the main menu "Environment measuring channels". The corresponding measuring channel can be configured there.
These are described in the following chapters.

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4.2.1 CO2 measurement

The following settings are available:

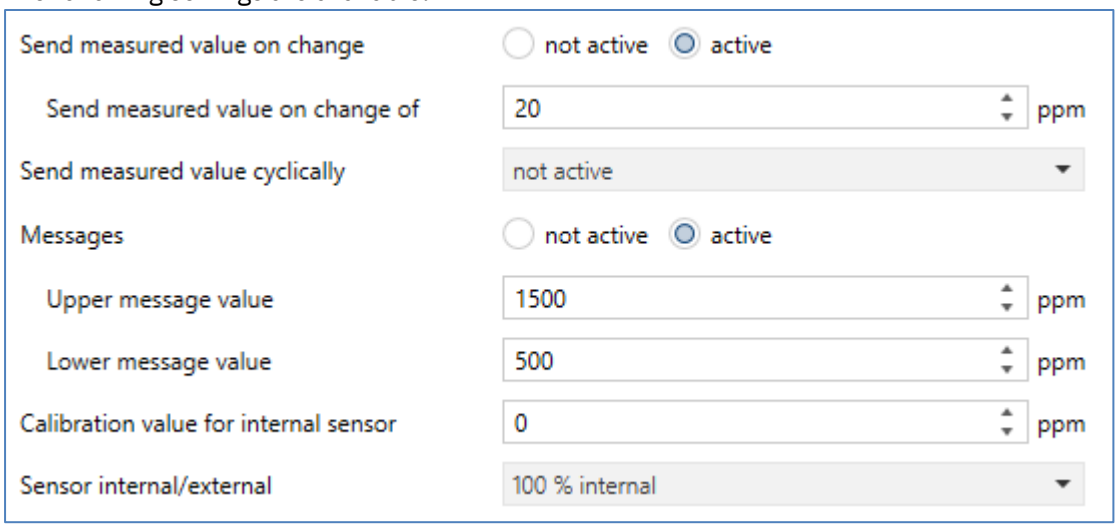

Figure 5: Settings – CO2 measurement

The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Send measured value on change	▪ **not active** • active	Setting whether the measured value should be sent on change.
Send measured value on change of	10 ... 500 ppm **[20]**	Setting at which change the measured value should be sent. **Only visible if "Send measured value on change" is activated.**
Send measured value cyclically	**not active** 1 min – 60 min	Setting whether and at what interval the measured value is sent cyclically.
Messages	▪ **not active** • active	Activation of the message function.
Upper message value	400 ... 2000 ppm **[1500 ppm]**	Setting range of the upper/lower message value. **Only visible when parameter "Messages" is activated.**
Lower message value	400 ... 2000 ppm **[500 ppm]**	
Calibration value for internal sensor	-500 ... 500 ppm **[0 ppm]**	Adjustment for internal sensor.
Sensor internal/external	▪ **100% internal** ▪ 90 % internal/ 10 % external ▪ 80 % internal/ 20 % external ▪ ... ▪ 10 % internal/ 90 % external ▪ 100 % external ▪ maximum value	Setting of the weighting between internal and external sensor.

Table 7: Settings – CO2 measurement

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The setting "**Send measured value on change**" can be used to set the change on which the sensor sends its current temperature value. If set to "not active", the sensor does not send a value, regardless of the size of the change.
The setting "**Send measured value cyclically**" can be used to set the intervals at which the sensor sends its current measured value. The cyclical sending function can be activated or deactivated independently of the setting "Send measured value on change". Measured values are also sent if the sensor has not detected a change. If both parameters are deactivated, a value is never sent.

Important: After reset/programming, the first measured value is sent after approx. 1 minute.

With the "**Messages**" function, two message values (upper and lower message value) can be parameterized. The two functions each have their own communication object.
Principle:
If the upper message value is exceeded, a "1" is sent. If it is undershot again, a "0" is sent.
If the value falls below the lower message value, a "1" is sent. If it is exceeded again, a "0" is sent.

A correction value can be set via the parameter "**Calibration value for internal sensor**". This is used to increase/decrease the actual measured value. If, for example, a value of "100" is set, the measured CO2 value is increased by 100 ppm.

An external sensor can be activated or deactivated via the weighting "**Sensor internal/external**". If the weighting is set to 100% internal, no external sensor is activated and no communication object appears for the external sensor. With any other setting, an external sensor is activated and the associated object appears. The "mixed" value is sent to the bus via the "Send measured value" object.
With the "maximum value" setting, the higher of the two measured values (internal/external) is always output

Important: The external sensor is monitored with a time of 30 minutes. If no new value is received within this time, only the internal sensor is used!
At the same time, an alarm with a "1" is sent to the "External sensor error" object. If an external value is received again, the alarm is reset with a "0".

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
1	CO2 measurement – Send measured value	2 Byte	Sending the current CO2 measured value
2	CO2 measurement – External sensor input	2 Byte	Receives the temperature of the external sensor
3	CO2 measurement – Maximum value exceeded	1 Bit	Sends a message if the upper message value is exceeded
4	CO2 measurement – Minimum value fallen below	1 Bit	Sends a message when the value falls below the lower message value
5	CO2 measurement – Error external sensor	1 Bit	Sends an error message if the sensor does not send a value for a certain time

Table 8: Communication objects – CO2 measurement

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4.2.2 VOC measurement

The following settings are available:

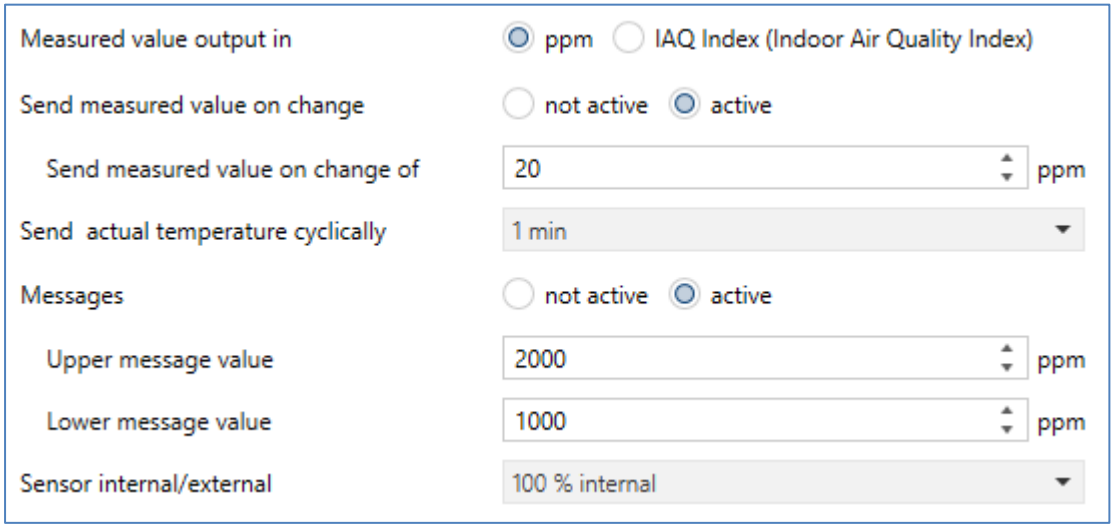

Figure 6: Settings – VOC measurement

The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Measured value output in	• **ppm** • IAQ Index (Indoor Air Quality Index)	Setting for how the measured value is to be output.
IAQ Index description	IAQ Index / Air Quality 0 - 50 Excellent 51 - 100 Good 101 - 150 Lightly polluted 151 - 200 Moderately polluted 201 - 250 Heavily polluted 251 - 350 Severely polluted >351 Extremely polluted	Information about the classification of the IAQ index (Indoor Air Quality Index). **Displayed when "Measured value output in" is selected as "IAQ Index".**
Send measured value on change	▪ **not active** • active	Setting whether the measured value should be sent on change.
Send measured value on change of	10 ... 500 ppm **[20]**	Setting at which change the measured value should be sent. **Unit depends on the selection of "Measured value output".** **Only visible if "Send measured value on change" is activated.**
	1 ... 50 **[5]**	
Send measured value cyclically	**not active** 1 min – 60 min	Setting whether and at what interval the measured value is sent cyclically.
Messages	▪ **not active** • active	Activation of the message function.
Upper message value	100 ... 5000 ppm **[2000]**	Setting the upper signal value. **Visible when "Messages" is active.** **Unit depends on the selection of "Measured value output".**
	0 ... 500 **[200]**	
Lower message value	100 ... 5000 ppm **[1000]**	
	0 ... 500 **[50]**	Setting the lower signal value.

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Sensor internal/external	▪ **100% internal** ▪ 90 % internal/ 10 % external ▪ 80 % internal/ 20 % external ▪ ... ▪ 10 % internal/ 90 % external ▪ 100 % external ▪ maximum value	Setting the weighting between internal and external sensor.

Table 9: Settings – VOC measurement

With the selection "**Measured value output in**" you can determine whether the VOC measured value is output in ppm or as IAQ index.
The IAQ Index (Indoor Air Quality Index) describes the indoor air quality. The classification is described with the parameter "**IAQ Index Description**" in the corresponding screen.
The setting "**Send measured value on change**" can be used to set the change on which the sensor sends its current temperature value. If set to "not active", the sensor does not send a value, regardless of the size of the change.
The setting "**Send measured value cyclically**" can be used to set the intervals at which the sensor sends its current measured value. The cyclical sending function can be activated or deactivated independently of the setting "Send measured value on change". Measured values are also sent if the sensor has not detected a change. If both parameters are deactivated, a value is never sent.

Important: After reset/programming, the first measured value is sent after approx. 1 minute.

With the "**Messages**" function, two message values (upper and lower message value) can be parameterized. The two functions each have their own communication object.
Principle:
If the upper message value is exceeded, a "1" is sent. If it is undershot again, a "0" is sent.
If the value falls below the lower message value, a "1" is sent. If it is exceeded again, a "0" is sent.

An external sensor can be activated or deactivated via the weighting "**Sensor internal/external**". If the weighting is set to 100% internal, no external sensor is activated and no communication object appears for the external sensor. With any other setting, an external sensor is activated and the associated object appears. The "mixed" value is sent to the bus via the "Send measured value" object. With the "maximum value" setting, the higher of the two measured values (internal/external) is always output.

Important: The external sensor is monitored with a time of 30 minutes. If no new value is received within this time, only the internal sensor is used!
At the same time, an alarm with a "1" is sent to the "External sensor error" object. If an external value is received again, the alarm is reset with a "0".

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
8	VOC measurement – Send measured value	2 Byte	Sending the current VOC measured value
9	VOC measurement – External sensor input	2 Byte	Receives the temperature of the external sensor
10	VOC measurement – Maximum value exceeded	1 Bit	Sends a message if the upper message value is exceeded
11	VOC measurement – Minimum value fallen below	1 Bit	Sends a message when the value falls below the lower message value
12	VOC measurement – Error external sensor	1 Bit	Sends an error message if the sensor does not send a value for a certain time

Table 10: Communication objects – VOC measurement

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4.2.3 Temperature measurement

The following settings are available:

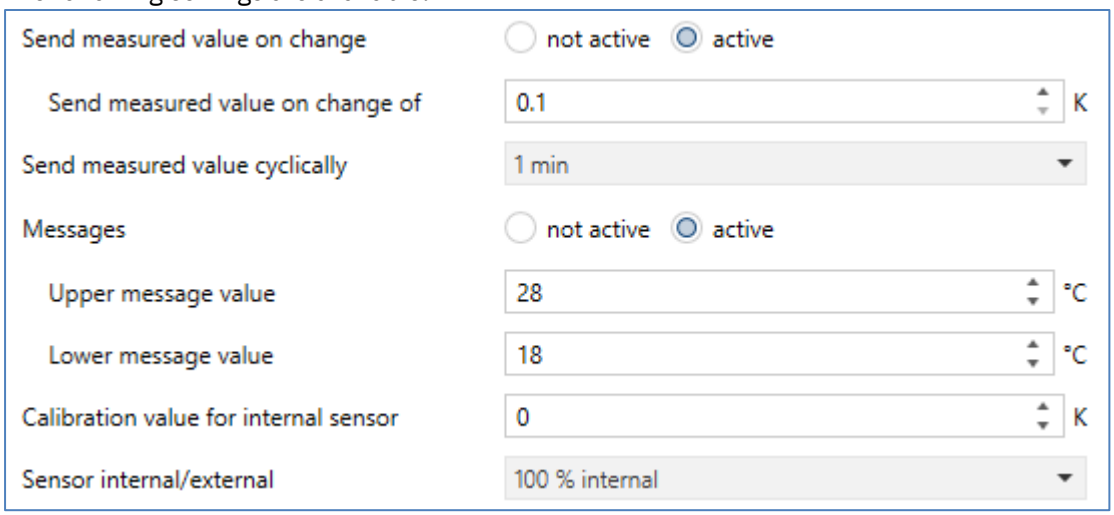

Figure 7: Settings – Temperature measurement

The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Send measured value on change	• **not active** • active	Setting whether the measured value should be sent on change.
Send measured value on change of	0.1 ... 2 K **[0.1 K]**	Setting at which change the measured value should be sent. **Only visible if "Send measured value on change" is activated.**
Send measured value cyclically	**not active** 1 min – 60 min	Setting whether and at what interval the measured value is sent cyclically.
Messages	• **not active** • active	Activation of the message function.
Upper message value	20 ... 45 °C **[28 °C]**	Setting range of the upper/lower message value. **Only visible when parameter "Messages" is activated.**
Lower message value	3 ... 30 °C **[18 °C]**	
Calibration value for internal sensor	-10 ... 10 K **[0 K]**	Adjustment for internal sensor.
Sensor internal/external	• **100% internal** • 90 % internal/ 10 % external • 80 % internal/ 20 % external • ... • 10 % internal/ 90 % external • 100 % external • maximum value	Setting the weighting between internal and external sensor.

Table 11: Settings – Temperature measurement

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The setting "**Send measured value on change**" can be used to set the change on which the sensor sends its current temperature value. If set to "not active", the sensor does not send a value, regardless of the size of the change.
The setting "**Send measured value cyclically**" can be used to set the intervals at which the sensor sends its current measured value. The cyclical sending function can be activated or deactivated independently of the setting "Send measured value on change". Measured values are also sent if the sensor has not detected a change. If both parameters are deactivated, a value is never sent.

Important: After reset/programming, the first measured value is sent after approx. 1 minute.

With the "**Messages**" function, two message values (upper and lower message value) can be parameterized. The two functions each have their own communication object.
Principle:
If the upper message value is exceeded, a "1" is sent. If it is undershot again, a "0" is sent.
If the value falls below the lower message value, a "1" is sent. If it is exceeded again, a "0" is sent.

A correction value can be set via the parameter "**Calibration value for internal sensor**". This is used to increase/decrease the actual measured value. This setting makes sense if the sensor has been installed in an unfavourable location, such as above a radiator or in a draught area. The temperature sensor sends the corrected temperature value when this function is activated.

An external sensor can be activated or deactivated via the weighting "**Sensor internal/external**". If the weighting is set to 100% internal, no external sensor is activated and no communication object appears for the external sensor. With any other setting, an external sensor is activated and the associated object appears. The "mixed" value is sent to the bus via the "Send measured value" object.

Important: The external sensor is monitored with a time of 30 minutes. If no new value is received within this time, only the internal sensor is used!
At the same time, an alarm with a "1" is sent to the "External sensor error" object. If an external value is received again, the alarm is reset with a "0".

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
15	Temperature measurement – Send measured value	2 Byte	Sending the current measured value
16	Temperature measurement – External sensor input	2 Byte	Receives the temperature of the external sensor
17	Temperature measurement – Maximum value exceeded	1 Bit	Sends a message if the upper message value is exceeded
18	Temperature measurement – Minimum value fallen below	1 Bit	Sends a message when the value falls below the lower message value
19	Temperature measurement – Error external sensor	1 Bit	Sends an error message if the sensor does not send a value for a certain time

Table 12: Communication objects – Temperature measurement

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4.2.4 Relative humidity measurement

The following settings are available:

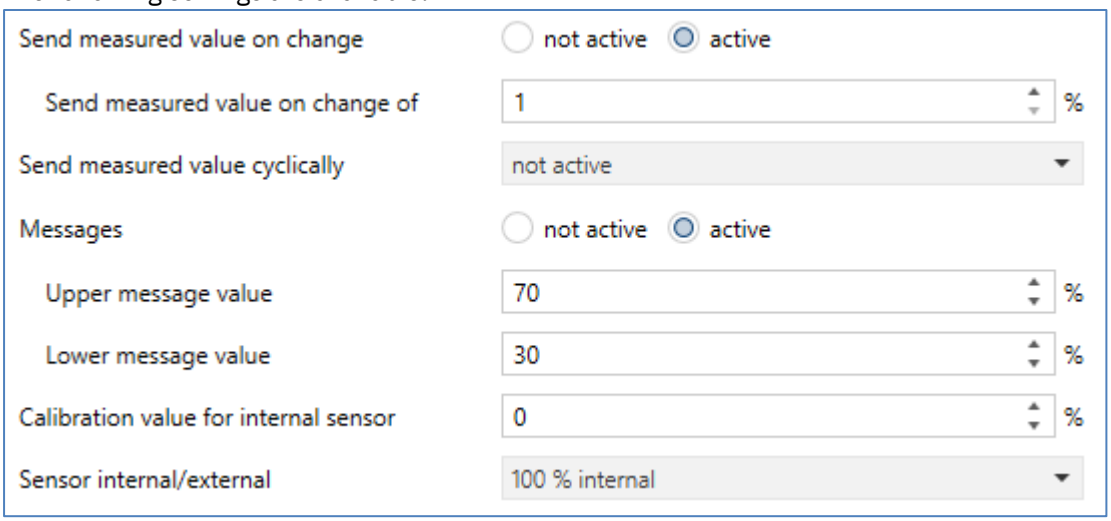

Figure 8: Settings – Relative humidity measurement

The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Send measured value on change	• **not active** • active	Setting whether the measured value should be sent on change.
Send measured value on change of	1 ... 10 % **[1 %]**	Setting at which change the measured value should be sent. **Only visible if "Send measured value on change" is activated.**
Send measured value cyclically	**not active** 1 min – 60 min	Setting whether and at what interval the measured value is sent cyclically.
Messages	• **not active** • active	Activation of the message function.
Upper message value	25 ... 100 % **[70 %]**	Setting range of the upper/lower message value. **Only visible when parameter "Messages" is activated.**
Lower message value	0 ... 75 % **[30 %]**	
Calibration value for internal sensor	-20 ... 20 % **[0 %]**	Adjustment for internal sensor.
Sensor internal/external	• **100% internal** • 90 % internal/ 10 % external • 80 % internal/ 20 % external • ... • 10 % internal/ 90 % external • 100 % external • maximum value	Setting the weighting between internal and external sensor.

Table 13: Settings – Relative humidity measurement

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The setting "**Send measured value on change**" can be used to set the change on which the sensor sends its current temperature value. If set to "not active", the sensor does not send a value, regardless of the size of the change.
The setting "**Send measured value cyclically**" can be used to set the intervals at which the sensor sends its current measured value. The cyclical sending function can be activated or deactivated independently of the setting "Send measured value on change". Measured values are also sent if the sensor has not detected a change. If both parameters are deactivated, a value is never sent.

Important: After reset/programming, the first measured value is sent after approx. 1 minute.

With the "**Messages**" function, two message values (upper and lower message value) can be parameterized. The two functions each have their own communication object.
Principle:
If the upper message value is exceeded, a "1" is sent. If it is undershot again, a "0" is sent.
If the value falls below the lower message value, a "1" is sent. If it is exceeded again, a "0" is sent.

A correction value can be set via the parameter "**Calibration value for internal sensor**". This is used to increase/decrease the actual measured value. The adjustment range is from -20 to 20 %, i.e. the measured value can be lowered by -20 % and raised to a maximum of 20 %. The sensor sends the corrected measured value when this function is activated.

An external sensor can be activated or deactivated via the weighting "**Sensor internal/external**". If the weighting is set to 100% internal, no external sensor is activated and no communication object appears for the external sensor. With any other setting, an external sensor is activated and the associated object appears. The "mixed" value is sent to the bus via the "Send measured value" object.
With the "maximum value" setting, the higher of the two measured values (internal/external) is always output.

Important: The external sensor is monitored with a time of 30 minutes. If no new value is received within this time, only the internal sensor is used!
At the same time, an alarm with a "1" is sent to the "External sensor error" object. If an external value is received again, the alarm is reset with a "0".

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
22	Relative humidity measurement – Send measured value	2 Byte	Sending the current measured value
23	Relative humidity measurement – External sensor input	2 Byte	Receives the temperature of the external sensor
24	Relative humidity measurement – Maximum value exceeded	1 Bit	Sends a message if the upper message value is exceeded
25	Relative humidity measurement – Minimum value fallen below	1 Bit	Sends a message when the value falls below the lower message value
26	Relative humidity measurement – Error external sensor	1 Bit	Sends an error message if the sensor does not send a value for a certain time

Table 14: Communication objects – Relative humidity measurement

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4.3 Air quality functions

The following settings are available:

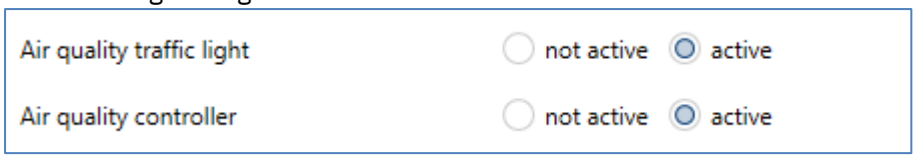

Figure 9: Settings – Air quality functions

Depending on the activation of the various functions, a submenu appears under the main menu "Air quality functions". The corresponding function can be configured there.

4.3.1 Air quality traffic light

The following settings are available:

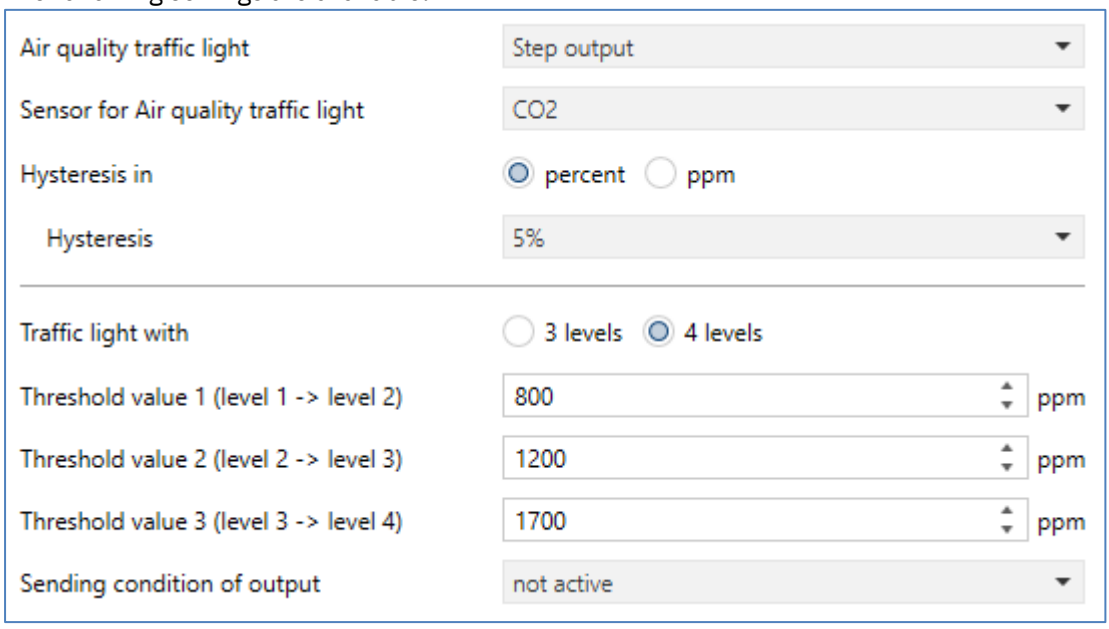

Figure 10: Settings – Air quality traffic light

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The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Air quality traffic light	• Step output • Scene output • RGB output • HSV output	Setting for what the output is to be used as.
Sensor for Air quality traffic light	• **CO2** • VOC(ppm) • VOC (IAQ Index)	Setting of the sensor according to which the air quality light operates.
Hysteresis in	• **percent** • ppm	**When selecting „CO2“ and „VOC (ppm)“** Setting with which unit the hysteresis is determined. **When selecting „VOC (IAQ Index).**
	• percent • **IAQ**	
Hysteresis	0 ... 20 % **[5 %]**	Setting the hysteresis in „percent“.
	10 ... 500 ppm **[100 ppm]**	Setting the hysteresis in „ppm“.
	0 ... 50 **[5]**	Setting the hysteresis for selection „IAQ“
Traffic light with	• **3 levels** • 4 levels	Setting whether the traffic light should work in 3 or 4 levels.
Colour for level 1 level 2 level 3 level 4	#00FF00 #FFFF00 #FF8000 #FF0000	Setting the colours for the different levels. **- Only with "RGB or HSV output“.** **- level 4 only with setting „4 levels“.**
Scene number for level 1 level 2 level 3 level 4	1 – 64 **[1]** **[2]** **[3]** **[4]**	Setting the scene numbers for the different levels. **- Available with "Scene output“.** **- level 4 only with setting „4 levels“.**
Threshold value 1 (level 1 -> level 2) Threshold value 2 (level 2 -> level 3) Threshold value 3 (level 3 -> level 4)	0 ... 2000 ppm / 0 ... 500 **[800] [800]** **[1200] [1500]** **[1700]** **[100] [100]** **[250] [300]** **[400]**	Setting range of the threshold values at which switching is to take place. (left column: ppm; right column: IAQ)) **- Unit depending on setting "Sensor for air quality traffic light“.** **- Threshold value 3 only available with setting “4 levels".**
Sending condition of output	• **not active** • on change • cyclic • cyclic and on change	Setting whether and when the output object is to be sent.
Send cyclically every...	1 min – 60 min **[60 min]**	Setting at which interval the measured value is sent cyclically. **Only if "cyclic..." is active**.

Table 15: Settings – Air quality traffic light

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The "**Air quality traffic light**" parameter determines how the function is implemented.
If "**Step output**" is selected, the different levels are sent via 1-bit objects.
If "**Scene output**" is selected, a scene can be sent for the respective traffic light level.
If "**RGB output**" or "**HSV output**" is selected, a 3-byte colour value is sent for the respective traffic light level.

The reference sensor for the traffic light control is set via "**Sensor for air quality traffic light**".

The **"Hysteresis"** setting adjusts the switching frequency between the thresholds. Depending on the selected sensor, the unit of the hysteresis can be set in percent, ppm or IAQ.

The **"threshold values"** for switching between the levels can be freely determined. The unit for the values corresponds to the selected sensor.

With the "**Sending condition of output**" it can be set whether and how the output value is to be sent. If "**cyclic...**" is selected, the transmission interval can also be set.

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
29	Air quality traffic light – Output level 1	1 Bit	Switching of output level 1
30	Air quality traffic light – Output level 2	1 Bit	Switching of output level 2
31	Air quality traffic light – Output level 3	1 Bit	Switching of output level 3
32	Air quality traffic light – Output level 4	1 Bit	Switching of output level 4
33	Air quality traffic light – Output RGB	3 Byte	Sending a RGB colour value
33	Air quality traffic light – Output HSV	3 Byte	Sending a HSV colour value
34	Air quality traffic light – Output Scene	1 Byte	Sending a scene number

Table 16: Communication objects – Air quality traffic light

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4.3.2 Air quality controller

The menu item "**Air quality control**" is divided into individual chapters for better understanding. Some parameters are generally valid for all controllers. This is followed by the chapters with the specific settings of the individual controller types. Finally, there are more generally valid points.

At the beginning, a controller is activated that is to be configured in the following:

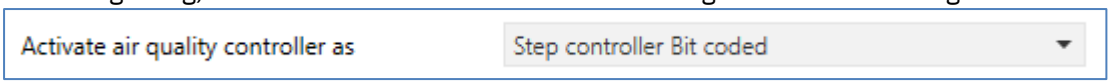

Figure 11: Settings – Activation of air quality controller

The following options are available:

- Step controller Bit coded
- Step controller binary coded
- Step controller as Byte
- PI controller

The controllers differ in the type of output (Bit or Byte objects). With the PI controller, the proportional component and integral component of the control can also be configured individually.

4.3.2.1 General parameters

The parameters described here are available and valid for all controller types.

The following illustration shows the available settings:

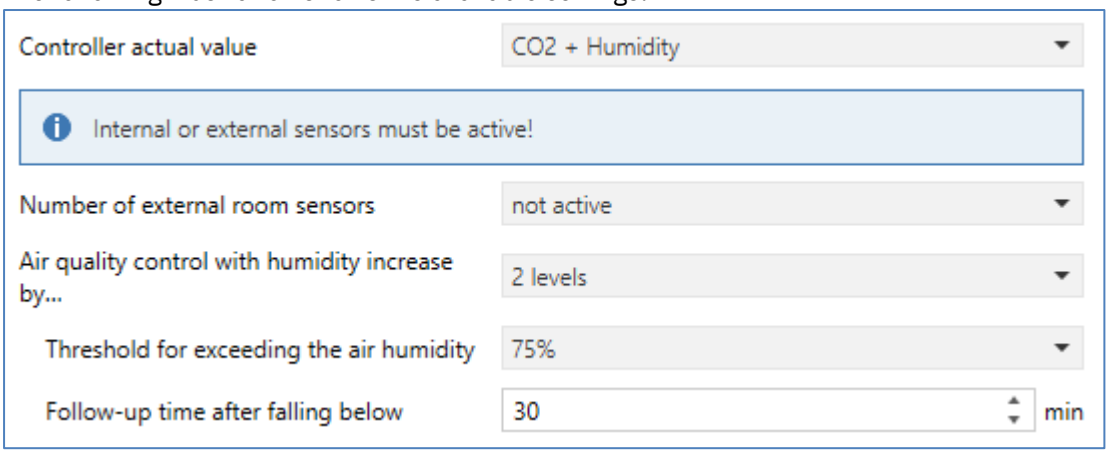

Figure 12: Settings – Air quality controller: General parameters

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The table shows the possible settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Controller actual value	▪ **CO2** ▪ VOC (ppm) ▪ VOC (IAQ Index) ▪ CO2 + Humidity ▪ VOC (ppm) + Humidity ▪ VOC (IAQ Index) + Humidity	Setting, which sensors the controller uses as a basis for control.
Number of external Room sensors	**not active** 1 ... 10	Activation of additional, external sensors. **When selecting one sensor in "Controller actual value".**
	not active 1 + 1, 2 + 2 ... 5 +5	Activation of additional, external sensors. **When selecting two sensors in "Controller actual value".**
Air quality control with humidity increase by...	**not active** 1 level ... 4 levels	Setting whether increased humidity influences the control. **Displayed if "+ Humidity" is active for "Controller actual value".** **Selection (levels/%) depending on the controller type (PI or step controller).**
	not active 25%, 50%, 75%, 100%	
Threshold for exceeding the air humidity	0 – 100% **[75%]**	Setting from which increase in humidity the control reacts to it.
Follow-up time after falling below	1 – 60 min **[30 min]**	Setting of the time from when the controller switches back to the previous control after the value falls below the threshold.

Figure 13: Settings – Air quality controller: General parameters

Controller actual value
Here you set which variable(s) the controller uses as a basis for control. This can be only one sensor (CO2 or VOC) or two sensors (CO2 respectively VOC + humidity).

Number of external Room sensors
The parameter makes it possible to integrate further sensors into the control in addition to the respective integrated sensor. This can be important if, for example, a central ventilation control contains several rooms. Each room has its own sensor and all sensors are included in the calculation.
If only one sensor is selected for the "Controller actual value", up to 10 external room sensors can be set. If two sensors are selected (CO2 + humidity, VOC + humidity), 5 external sensors of both types can be activated. The highest measured value is decisive for the level to be switched or the control value to be sent.

Example:
Controller actual value: "CO2 + humidity", External room sensors: "5 + 5".
5 external CO2 sensors and 5 external humidity sensors can be included.
Special feature: If 5 CO2 sensors but only 3 humidity sensors are used with this setting, the unused sensors are preset with the value "0" and do not influence the control.

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Air quality control with humidity increase by...
The parameter is only displayed if a selection is made with "+ Humidity" as "Controller actual value". Here you can set by which level (" Step controller") or by which control value (PI controller) the air quality control is to be raised as soon as a certain threshold value for the air humidity is exceeded. This value is determined with the setting "**Threshold for exceeding the humidity**".
The "**Follow-up time after falling below**" defines the minimum time by which the threshold value must be fallen below to return to the current control.

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
39	Air quality controller – CO2 Input 1, VOC Input 1	2 Byte	Input of an external measured value. DPT depending on the set parameter.
40	Air quality controller – CO2 Input 2, VOC Input 2	2 Byte	Input of an external measured value.
41	Air quality controller – CO2 Input 3, VOC Input 3	2 Byte	DPT depending on the set parameter.
42	Air quality controller – CO2 Input 4, VOC Input 4	2 Byte	Input of an external measured value.
43	Air quality controller – CO2 Input 5, VOC Input 5	2 Byte	DPT depending on the set parameter.
44	Air quality controller – CO2 Input 6, VOC Input 6, Humidity Input 1	2 Byte	Input of an external measured value.
45	Air quality controller – CO2 Input 7, VOC Input 7, Humidity Input 2	2 Byte	DPT depending on the set parameter.
46	Air quality controller – CO2 Input 8, VOC Input 8, Humidity Input 3	2 Byte	Input of an external measured value.
47	Air quality controller – CO2 Input 9, VOC Input 9, Humidity Input 4	2 Byte	DPT depending on the set parameter.
48	Air quality controller – CO2 Input 10, VOC Input 10, Humidity Input 5	2 Byte	Input of an external measured value.

Table 17: Communication objects – Air quality controller: General parameters

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4.3.2.2 Specific settings – Step controller Bit coded

The following illustration shows the specific settings for this type of controller:

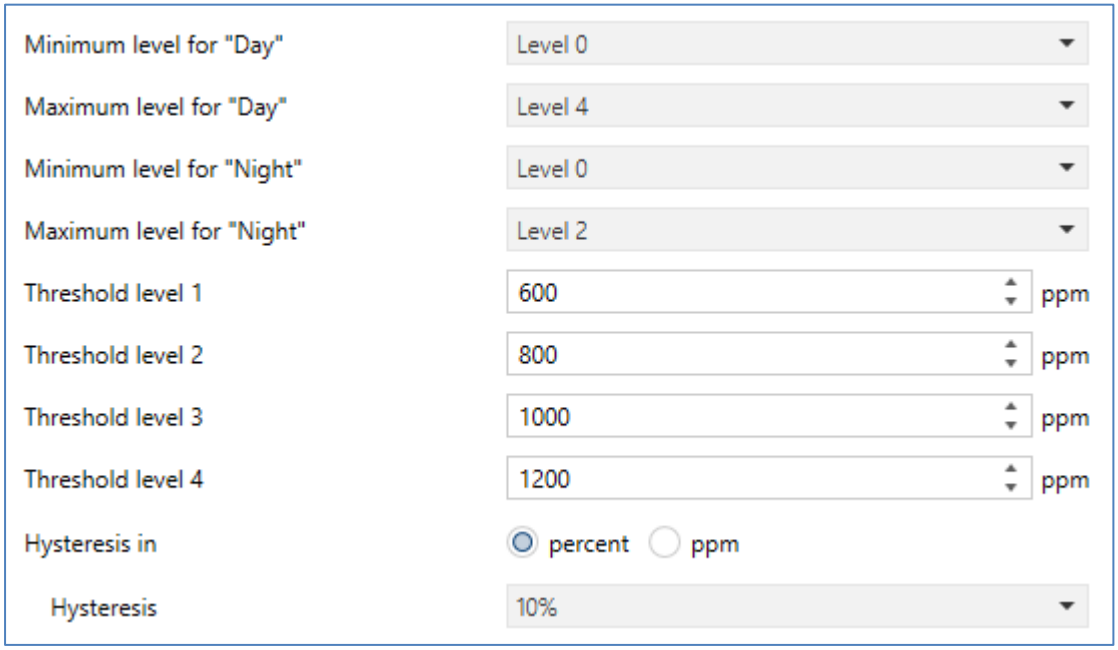

Figure 14: Settings – Step controller Bit coded

The following table shows the specific settings for this controller type:

ETS-Text	Dynamic range **[Default value]**		Comment
Minimum level for „Day“	Level 0 – Level 4 **[Level 0]**		Defines the minimum or maximum level to be switched in "Day" or "Night" mode.
Maximum level for „Day“	Level 0 – Level 4 **[Level 4]**		
Minimum level for „Night“	Level 0 – Level 4 **[Level 0]**		
Maximum level for „Night“	Level 0 – Level 4 **[Level 4]**		
Threshold level 1 Threshold level 2 Threshold level 3 Threshold level 4	400 … 2000 ppm **[600]** **[800]** **[1000]** **[1200]**	50 … 500 **[80]** **[160]** **[240]** **[320]**	Setting range of the threshold values at which switching is to take place. **Unit (ppm/IAQ) depending on the selection in "Controller actual value".**
Hysteresis in	• **percent** • ppm		Setting with which unit the hysteresis is determined. **Selection depends on the setting in "Controller actual value".**
	• percent • **IAQ**		
Hysteresis	0 … 20 % **[10 %]**		Setting the hysteresis in „percent“.
	10 … 500 ppm **[50 ppm]**		Setting the hysteresis in „ppm“.
	0 … 50 **[5]**		Setting the hysteresis when "IAQ" is selected.

Table 18: Settings – Step controller Bit coded

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Minimum/Maximum level for „Day“/“Night“
With these settings, the air quality control can be limited. A fixed level can be set for the respective parameter, which cannot be exceeded or undercut.

Note: The **switchover for "Day/Night"** is made in the "General Settings" menu. If this is "not active", the parameters are only called "Minimum level" or "Maximum level".

Threshold level 1 – 4
The threshold values at which the switching between the different levels is to take place are set here.

The following picture shows the switching behaviour of the outputs depending on the threshold values:

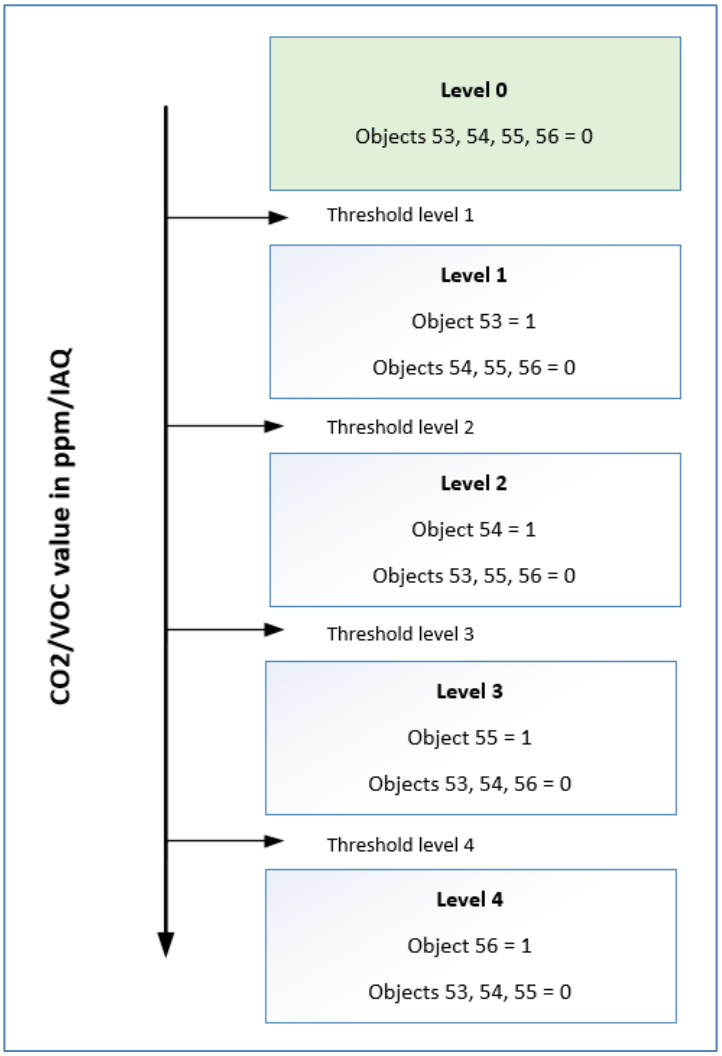

Figure 15: Switching behaviour – Step controller

Hysteresis
The hysteresis is used to avoid too frequent switching between the different levels. The parameter "**Hysteresis in**" defines the unit of the hysteresis. The definition depends on the selection in the "Controller actual value" parameter.

Example of hysteresis:
Threshold value level 1: 600 ppm. Hysteresis in "percent": "10%".
At 630 ppm the control switches from level 0 to level 1. At 570 ppm the control switches from level 1 back to level 0. If the measured value changes within the two limits, there is no changeover.

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The associated communication objects are shown in the table:

Number	Name/Object function	Length	Usage
53	Air quality controller – Output level 1	1 Bit	Switching the 1st output level
54	Air quality controller – Output level 2	1 Bit	Switching the 2nd output level
55	Air quality controller – Output level 3	1 Bit	Switching the 3rd output level
56	Air quality controller – Output level 4	1 Bit	Switching the 4th output level
57	Day / Night – Day = 1 / Night = 0, Night = 1 / Day = 0	1 Bit	Switchover between Day and Night Operation

Table 19: Communication objects – Step controller Bit coded

For more information on the parameters that are not described in detail, see the following chapters:

4.3.2.1 General parametersFor more information on the parameters that are not described in detail, see the following chapters:

4.3.2.1 General parametersFehler! **Ungültiger Eigenverweis auf Textmarke.**

4.3.2.7 Send setpoint/output cyclically

4.3.2.6 Behaviour at lock

4.3.2.7 Send setpoint/output cyclically

4.3.2.3 Specific settings – Step controller binary coded

The functionality of the binary-coded step controller is identical to that of the step controller (Bit-coded) as described in chapter 4.3.2.2 Specific settings – Step controller Bit coded .

The only difference is that the output level is transmitted in binary code. Object 53 is bit 0, object 54 is bit 1 and object 55 is bit 2.

The following table shows the binary-coded switching of the output stage:

Normal step controller	Binary value	step controller binary coded
Level 0	000	Objects 53, 54 ,55 = 0
Level 1	001	Object 53 = 1, Objects 54 & 55 = 0
Level 2	010	Object 54 = 1 , Objects 53 & 55 = 0
Level 3	011	Objects 53 & 54 = 1, Object 55 = 0
Level 4	100	Object 55 = 1 , Objects 53 & 54 = 0

Table 20: Settings – Step controller binary coded

The following table shows the associated communication objects:

Number	Name/Object function	Length	Usage
53	Air quality controller – Output Bit 0	1 Bit	Setting the bit 0
54	Air quality controller – Output Bit 1	1 Bit	Setting the bit 1
55	Air quality controller – Output Bit 2	1 Bit	Setting the bit 2

Table 21: Communication objects – Step controller binary coded

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4.3.2.4 Specific settings – Step controller as Byte

The "Step controller as byte" sends a fixed control value in percent for each output level. Four values (level 1-4) can be defined. In addition, there is the state "Off" (0%) as level 0. This cannot be set in the parameters and is switched when the value falls below "Threshold level 1".

The following illustration shows the specific settings for this controller type:

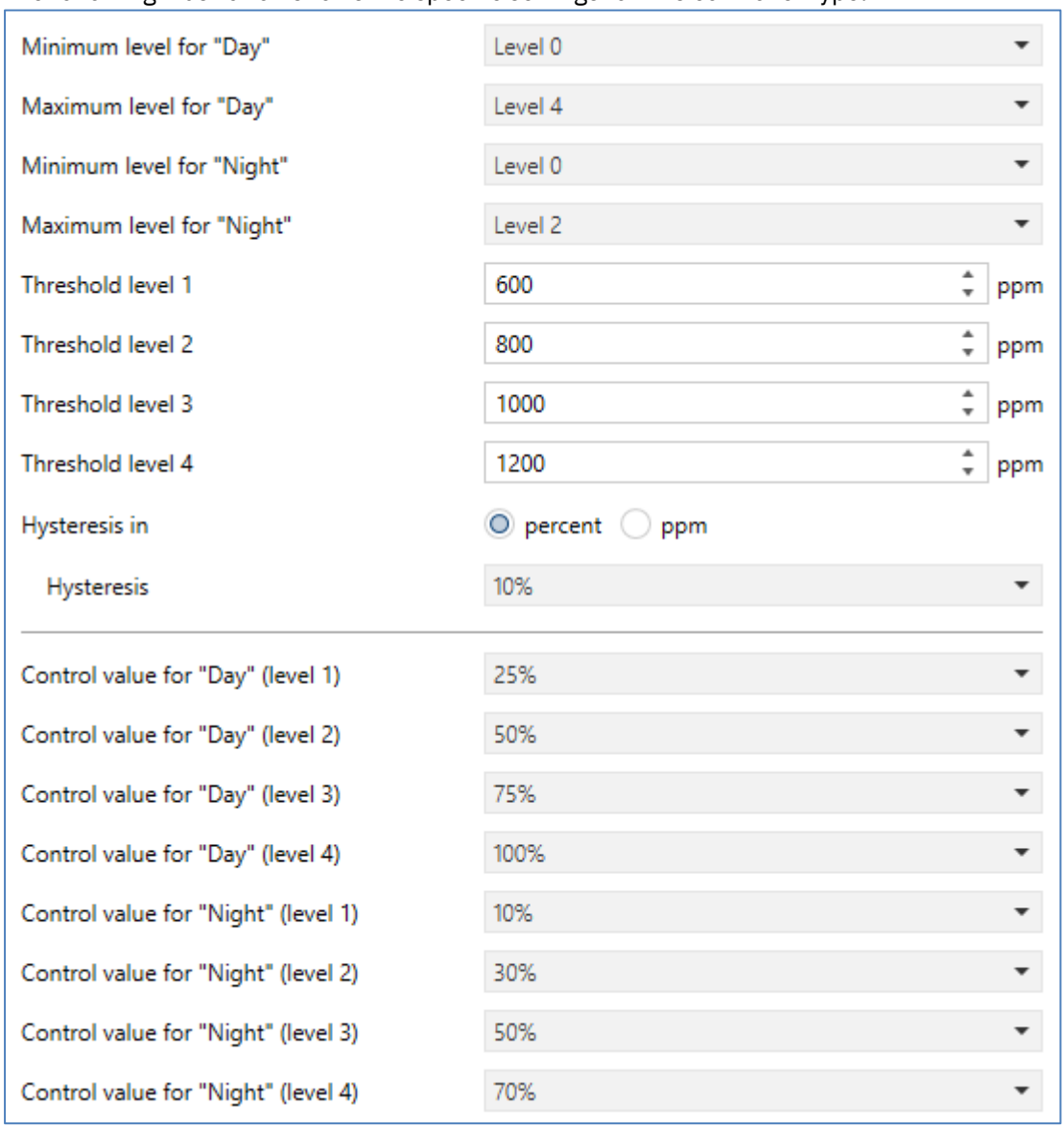

Figure 16: Settings – Step controller as Byte

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The following table shows the specific settings for this controller type:

ETS-Text	Dynamic range **[Default value]**		Comment
Minimum level for „Day“	Level 0 – Level 4 **[Level 0]**		Defines the minimum or maximum level to be switched in "Day" or "Night" mode.
Maximum level for „Day“	Level 0 – Level 4 **[Level 4]**		
Minimum level for „Night“	Level 0 – Level 4 **[Level 0]**		
Maximum level for „Night“	Level 0 – Level 4 **[Level 4]**		
Threshold level 1 Threshold level 2 Threshold level 3 Threshold level 4	400 ... 2000 ppm **[600]** **[800]** **[1000]** **[1200]**	0 ... 500 **[80]** **[160]** **[240]** **[320]**	Setting range of the threshold values at which switching is to take place. **Unit (ppm/IAQ) depending on the selection in "Controller actual value".**
Hysteresis in	• **percent** • ppm		Setting with which unit the hysteresis is determined. **Selection depends on the setting in "Controller actual value".**
	• percent • **IAQ**		
Hysteresis	0 ... 20 % **[10 %]**		Setting the hysteresis in „percent“.
	10 ... 500 ppm **[50 ppm]**		Setting the hysteresis in „ppm“.
	0 ... 50 **[5]**		Setting the hysteresis when "IAQ" is selected.
Control value for „Day“ (Level 1) (Level 2) (Level 3) (Level 4)	0 – 100% **[25%]** **[50%]** **[75%]** **[100%]**		Setting which control value is to be sent for the respective stage in "Day" or "Night" mode.
Control value for „Night“ (Level 1) (Level 2) (Level 3) (Level 4)	0 – 100% **[10%]** **[30%]** **[50%]** **[70%]**		

Table 22: Settings – Step controller as Byte

Minimum/Maximum level for „Day“/“Night“
With these settings, the air quality control can be limited. A fixed level can be set for the respective parameter, which cannot be exceeded or undercut.

Note: The **switchover for "Day/Night"** is made in the "General Settings" menu. If this is "not active", the parameters are only called "Minimum level" or "Maximum level".

Threshold level 1 – 4
The threshold values at which the switching between the different levels is to take place are set here.

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The following figure shows the switching behaviour of the outputs depending on the threshold values:

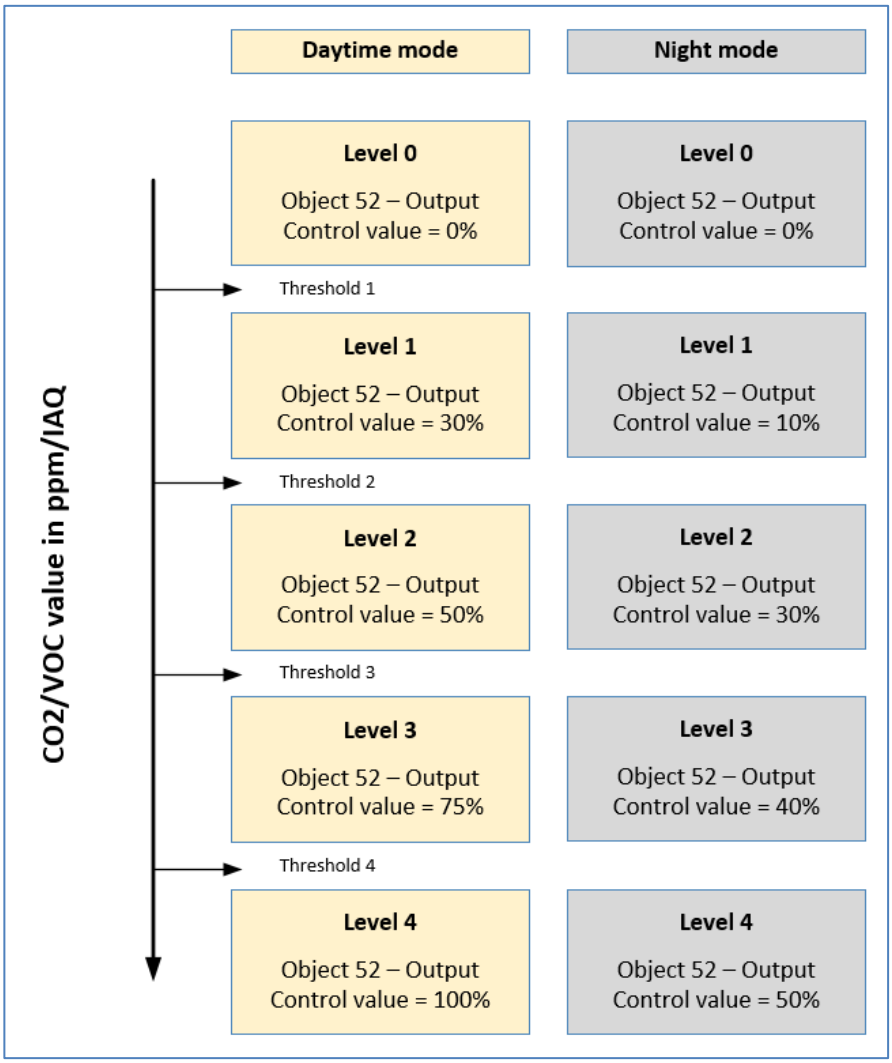

Figure 17: Diagram – Output: Step controller as Byte

Hysteresis

The hysteresis is used to avoid too frequent switching between the different levels. The parameter "**Hysteresis in**" defines the unit of the hysteresis. The definition depends on the selection in the "Controller actual value" parameter.

Example of hysteresis:

Threshold value level 1: 600 ppm. Hysteresis in "percent": "10%".

At 630 ppm the control switches from level 0 to level 1. At 570 ppm the control switches from level 1 back to level 0. If the measured value changes within the two limits, there is no changeover.

Control value for „Day“/“Night“ (Level 1 – 4)

The absolute values of the different levels are defined here. If the "Day/Night" object is activated in the "General Settings" menu, different values can be defined for "Day" or "Night" operation. If the "Day/Night" object is not active, the text addition "for Day" or "for Night" is omitted and only one control value can be defined in each case.

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The following table shows the communication objects:

Number	Name/Object function	Length	Usage
52	Air quality controller – Output control value	1 Byte	Sending the control value
57	Day / Night – Day = 1 / Night = 0, Night = 1 / Day = 0	1 Bit	Switchover between Day and Night Operation

Table 23: Communication object – Step controller as Byte

For more information on the parameters that are not described in detail, see the following chapters:

4.3.2.1 General parametersFor more information on the parameters that are not described in detail, see the following chapters:

4.3.2.1 General parametersFehler! **Ungültiger Eigenverweis auf Textmarke.**

4.3.2.7 Send setpoint/output cyclically

4.3.2.6 Behaviour at lock

4.3.2.7 Send setpoint/output cyclically

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4.3.2.5 Specific settings – PI controller

The PI controller, just like the "Step controller as byte", outputs a continuous control value from 0-100%. In contrast to this, however, the PI controller calculates its value depending on the difference between the set setpoint and the actual value, considering the set control parameters "proportional value" and "reset time".

The following illustration shows the specific settings for the PI controller (here the example with activated "Day/Night changeover"):

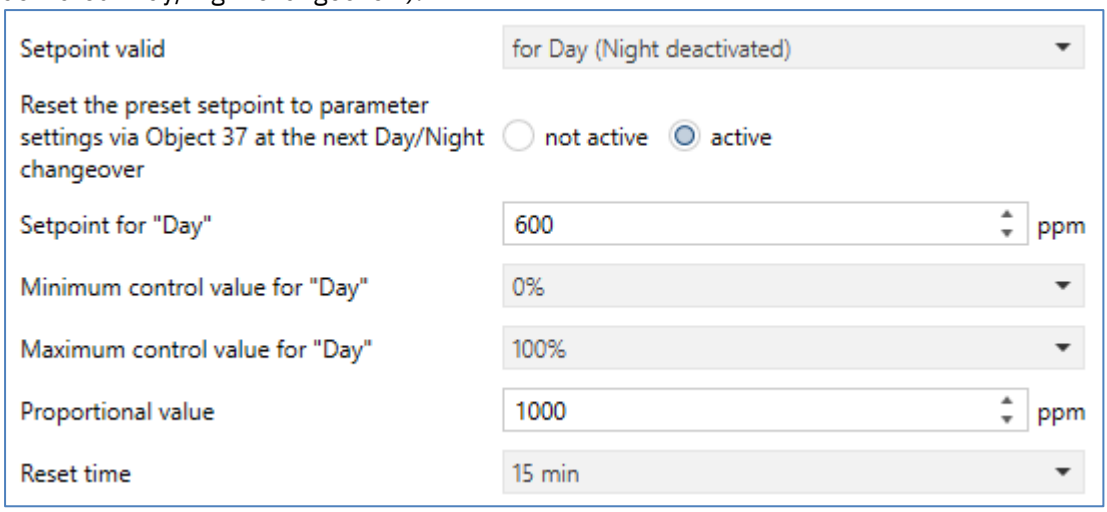

Figure 18: Settings – PI controller

The following table shows the specific settings available for this type of controller:

ETS-Text	Dynamic range **[Default value]**		Comment
Setpoint valid	• **for Day (Night deactivated)** • for Night (Day deactivated) • for Day and Night		Setting for which mode the setpoint is valid and thus the control is to be activated. **Only available if "Day/Night switchover" is active.**
Reset the preset setpoint to parameter settings via object 37 at the next Day/Night switchover.	• not active • **active**		Setting whether the "Day/Night changeover" should delete a preset setpoint. **Only available if "Day/Night switchover" is active.**
Setpoint for „Day“	400 ... 2000 ppm **[600]**	50 ... 500 **[80]**	Setting range of the control values at which switching is to take place. **Unit (ppm/IAQ) depending on the selection in "Controller actual value".**
Setpoint for „Night“	400 ... 2000 ppm **[700]**	50 ... 500 **[100]**	
Minimum control value for „Day”	0 – 100% **[0%]**		Defines the minimum or maximum control value to be sent in "Day" or "Night" mode.
Maximum control value for „Day”	0 – 100% **[100%]**		
Minimum control value for ”Night”	0 – 100% **[0%]**		
Maximum control value for ”Night”	0 – 100% **[30%]**		

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Proportional value	100 ... 2000 ppm **[1000 ppm]**	10 ... 250 **[100]**	Setting of the P-component for the regulation. **Unit (ppm/IAQ) depending on the selection in "Controller actual value".**
Reset time	**15 min**, 30 min, 45 min ... 210min		Setting of the I-component for the regulation.

Table 24: Settings – PI controller

Setpoints
The parameter "**Setpoint valid**" can be used to set when a fixed setpoint is to be valid.

Important: This parameter is only available if "Day/Night switching" has been activated in the "General settings" menu.

The settings have the following effect:

- **for Day (Night deactivated)**
  With this setting, only one setpoint can be specified for "Day" operation. In "Night" mode, the control is switched off.
- **for Night (Day deactivated)**
  With this setting, only one setpoint can be specified for "Night" operation. In "Day" mode, the control is switched off.
- **for Day and Night**
  With this setting, two separate setpoints can be specified for Day and Night operation. In this way, the PI controller controls in "Day" or "Night" mode to the respective set value.

Reset the preset setpoint to parameter settings via object 37 at the next Day/Night switchover
With object 37 - "Preset setpoint", a new setpoint can be specified via visualisation, etc. Activating the parameter has the effect that the manual pre-setting of a new setpoint via this object 37 becomes invalid when switching between "Day" and "Night" operation and the parameter value is reloaded.
In the event of a reset or reprogramming, the configured setpoint always applies.

Minimum/Maximum control value for „Day“/“Night“
With this setting, the control value of the air quality control can be limited. If, for example, the fan is only to run at 30% in "Night" mode, to keep the noise level of the ventilation low or to avoid draughts, this can be realised here. Please note that the minimum/maximum values limit the control and thus the actual value may not be completely controlled up to the setpoint.
If the Day/Night object is activated in the "General Settings" menu, different values can be defined for "Day" or "Night" operation.

Note: If the "Day/Night" object is not active, the text addition "for Day" or "for Night" is omitted and only a "Minimum Value" and a "Maximum Value" can be defined.

Proportional value:
The proportional value stands for the P-component of a control. This leads to a proportional increase of the control value to the control difference.
A small proportional band leads to a fast control of the control difference. With a small proportional band, the controller reacts almost immediately and sets the control value almost to the maximum value (100%) even with small control differences. However, if the proportional band is selected too small, the risk of overshooting is very high.

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Reset time:

The reset time represents the I-component of a control. This leads to an integral approach of the actual value to the setpoint. A short reset time means a strong I component.
A short reset time causes the control value to quickly approach the control value set according to the proportional range. A long reset time, on the other hand, causes a slow approach to this value.

The following figure illustrates the interrelationships of PI control:

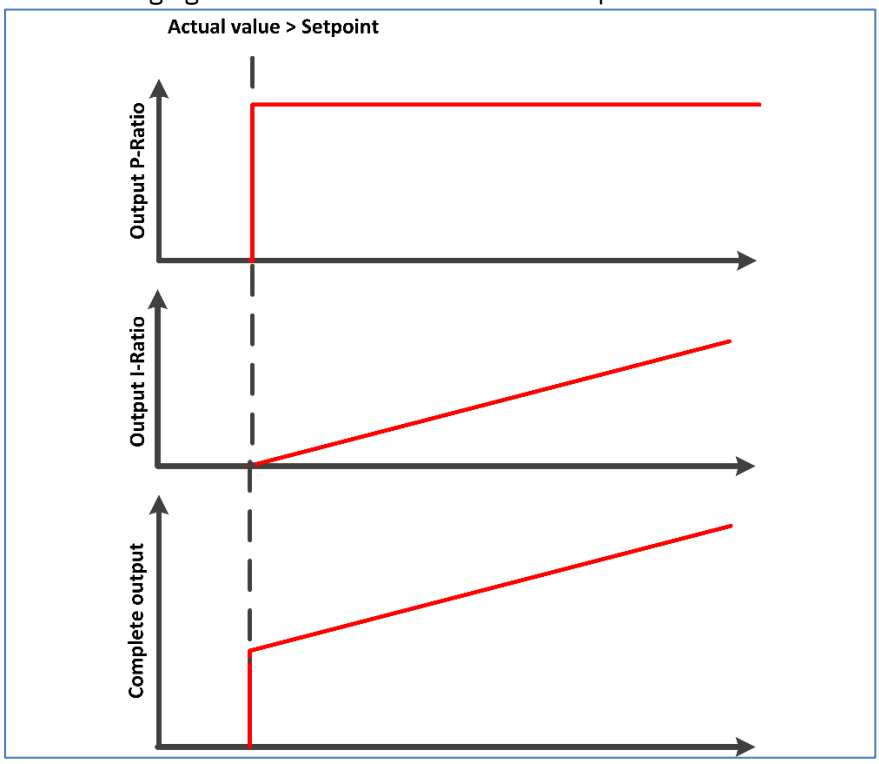

Figure 19: Diagram – Principle of the PI-Control

The following communication objects are available for this:

Number	Name/Object function	Length	Usage
37	Air quality control –Preset setpoint	2 Byte	Specification of a new absolute setpoint
38	Air quality control –Current setpoint	2 Byte	Display of the currently set setpoint
52	Air quality controller – Output control value	1 Byte	Sending the control value
57	Day / Night – Day = 1 / Night = 0, Night = 1 / Day = 0	1 Bit	Switchover between Day and Night Operation

Table 25: Communication objects – PI controller

For more information on the parameters that are not described in detail, see the following chapters:

4.3.2.1 General parameters**Fehler! Ungültiger Eigenverweis auf Textmarke.**

4.3.2.7 Send setpoint/output cyclically

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4.3.2.6 Behaviour at lock

This parameter is available for all configurable controllers.

The following illustration shows the setting in the ETS:

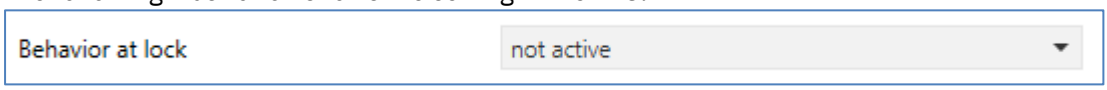

Figure 20: Settings – Behaviour at lock

The following table shows the available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Behaviour at lock	• **not active** • hold value and send cyclically • hold value • send a certain value • override control via object 58	Setting for how the controller should behave when a lock is set.
Level at lock	Level 0 ... Level 4 **[Level 1]**	Level to be sent during a lock. **With setting "send a certain value", for step controller "Bit coded" and "binary coded".**
Value at lock	0 % ... 100 % **[0 %]**	Control value to be sent during a lock. **With the setting "send a certain value", for "step controller as Byte" and "PI controller".**

Table 26: Settings – Behaviour at lock

The settings cause the following actions:

- **not active**
  Lock function is deactivated, and no object is displayed.
- **hold value and send cyclically**
  The current level or the current control value is held when the lock is set and does not change as long as the lock is active. This value is sent cyclically.
  Note: The time for cyclical sending is set in the next parameter “Send setpoint/output cyclically”.
- **hold value**
  The current level or control value is held when the lock is set and does not change as long as the lock is active.
- **send a certain value**
  The set level or the set value is called up when the lock is activated.
- **override control via object 58**
  Important: A lock must first be set. Afterwards, the control (current level or control value, depending on the type of control) can be "overridden" via object 58.
  The override of the levels (step controller Bit coded, step controller binary coded) is done via decimal value, where: value 0 = level 0, value 1 = level 1 ... value 4 = level 4.
  The override of the control value (step controller as Byte, PI controller) is done via percentage value.
  After resetting the lock with "0", the control continues in the currently calculated level or with the calculated control value.

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The associated communication objects are shown in the table:

Number	Name/Object function	Length	Usage
51	Air quality controller – Lock controller	1 Bit	Locking the output stage
58	Air quality controller – Override level, Override control value	1 Byte	Receive a value for override. DPT according to set parameter

Table 27: Communication objects – Lock function

4.3.2.7 Send setpoint/output cyclically

This parameter is available for all adjustable controllers.
This setting causes the output to be sent cyclically on the bus.

The following figure shows the setting in the ETS:

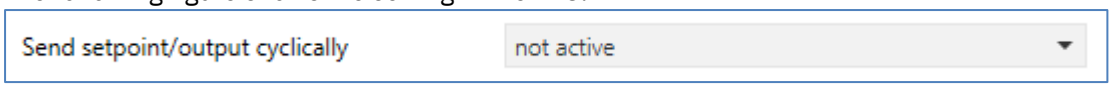

Figure 21: Settings – Send setpoint/output cyclically

The following table shows the associated communication objects:

ETS-Text	Dynamic range **[Default value]**	Comment
Send setpoint/output cyclically	**not active** 1 min – 60 min	Setting whether to send and in which cycle.

Table 28: Settings – Send setpoint/output cyclically

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4.4 Temperature controller

The temperature controller is activated via the "Operation mode" parameter.

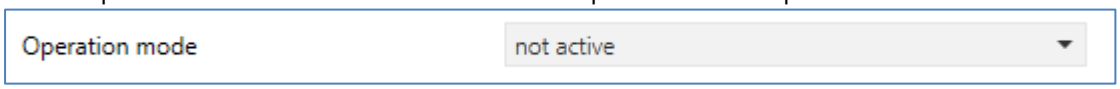

Figure 22: Settings – Activation of the controller

The table shows the possible settings for the operation mode:

ETS-Text	Dynamic range **[Default value]**	Comment
Operation mode	▪ **not active** ▪ Heating ▪ **Cooling** ▪ Heating and Cooling	Setting the controller operating mode. The other settings depend on the set control mode.

Table 29: Settings – Operation mode

If the setting "**not active**" is set for **operating mode**, the controller is deactivated and there are no further configuration options for the controller. As soon as the controller has been assigned a specific function, "**Heating**", "**Cooling**" or "**Heating & Cooling**", depending on the application, further settings can be made, and the "Controller parameters" menu also appears on the left-hand side.

The task of the control system is to adjust the actual temperature as close as possible to the specified setpoint. To realize this, several setting options are available to the user. The controller can influence the control value via 3 different control modes (PI control, 2-point control, PWM control). In addition, an additional stage can be assigned to the controller.

In addition, the controller has 4 different operating modes (Frost/Heat protection, Night, Comfort, Standby) for differentiated control of various requirement ranges.
Further functions of the controller are the manual setpoint adjustment, the dynamic setpoint adjustment considering the measured outdoor temperature, the setpoint specification via independent setpoints (as absolute values) as well as the operating mode selection after reset and integration of blocking objects.

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The picture on the following page shows the setting options (here for operating mode "Heating"):

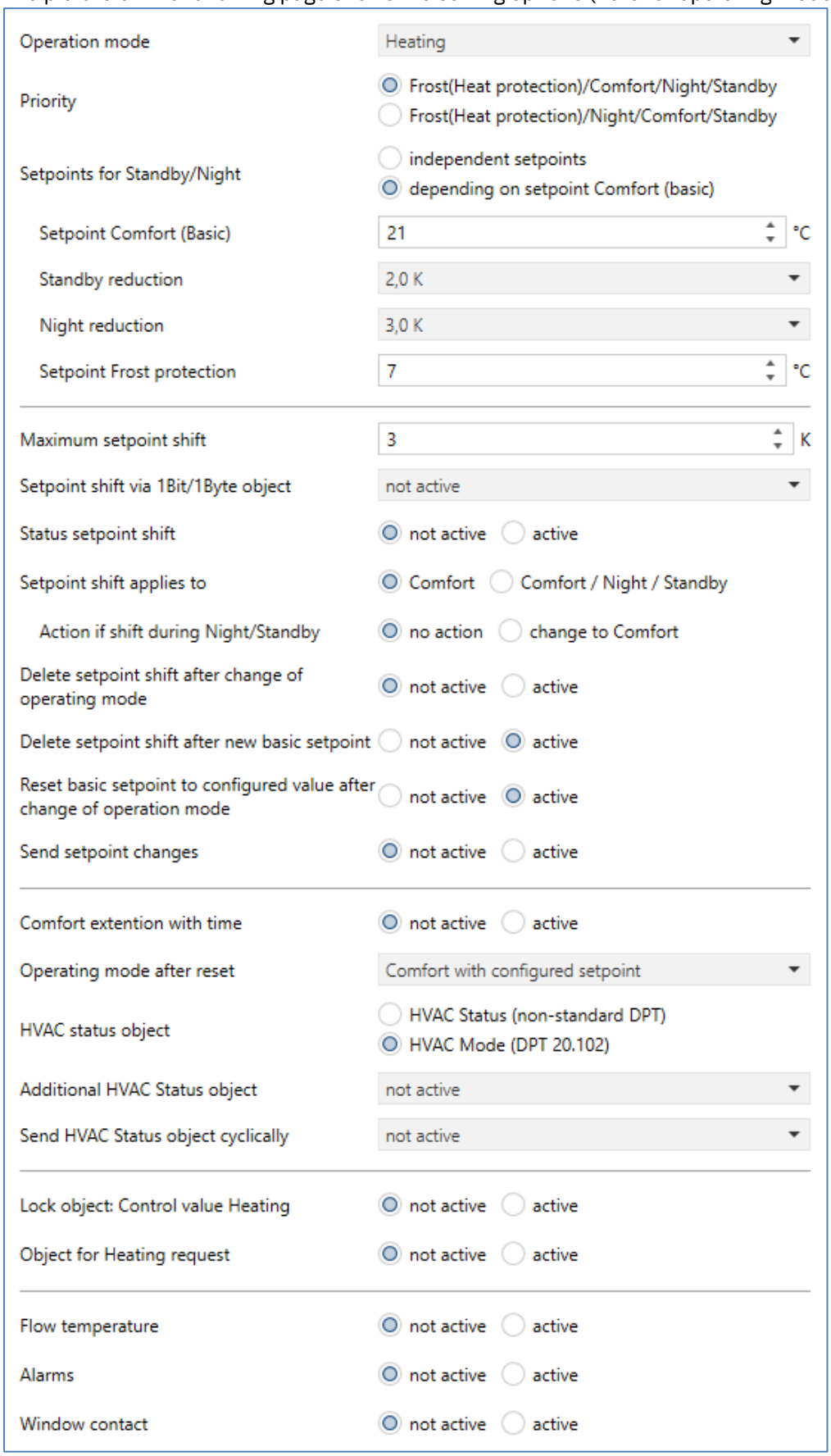

Figure 23: Settings – Temperature Controller

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4.4.1 Setpoints, Operating Modes & Priorities

As a basis, it must be determined in advance how the setpoints are specified:

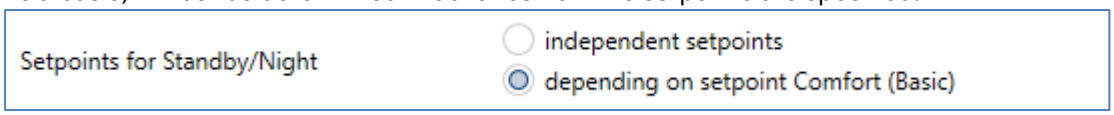

Figure 24: Settings – Setpoints for Standby/Night

The two options are described in detail in the next two chapters.

4.4.1.1 Depending on setpoint Comfort (Basic)

With the setting "depending on setpoint Comfort (Basic)"", the operating modes “Standby” and “Night” are always relative to the “setpoint Comfort (Basic)”. If this changes due to a setpoint specification, the values for “Standby” and “Night” also change. Therefore, the values for decrease and increase are given as a temperature difference in "K" (Kelvin). “Frost/Heat protection” does not change here and always remains at the parameterized value.

The following table shows the individual operating modes and their setting ranges:

ETS-Text	Dynamic range **[Default value]**	Comment
Setpoint Comfort (Basic)	7 ... 35 °C **[21 °C]**	**The basic Comfort value is the reference point of the control**.
Standby 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.
Night reduction/increase	0 K – 10,0 K **[3,0 K]**	Reduction (for " Heating") or increase (for "Cooling") of the temperature when the Night operating mode is selected. Is indicated relative to the basic comfort value.
Setpoint Frost protection	3 ... 12 °C **[7 °C]**	Setpoint of the Frost protection mode is set as absolute value. **Visible when "Heating" is active.**
Setpoint Heat protection	24 ... 40 °C **[35 °C]**	Setpoint of the Heat protection operating mode is set as absolute value. **Visible when "Cooling" is active.**
Dead zone between Heating and Cooling	1 K – 10,0 K **[2,0 K]**	Setting range for the dead zone (range in which the controller activates neither the heating nor the cooling process). **Visible when "Heating and Cooling" is active.**

Table 30: Settings – Operating modes and Setpoints (Depending on setpoint Comfort (Basic)

A new setpoint is specified via object 62 "Preset (Basic) Comfort setpoint".
In addition, there is a general object for the setpoint specification, the object "0 - Setpoint setting". If a value is sent via this, it also changes the basic Comfort value. The special feature is that a setpoint setting automatically switches to the "Comfort" operating mode. This applies to a setpoint in "Standby" or "Night" mode.

Important: **A setpoint setting is ignored in the "Frost-" or "Heat protection" operating mode!**

Background: Some visualisations send fixed values in "Comfort" and need this value to be reported back. This is only possible for the controller if it is also in "Comfort" mode.

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

The communication object for this operating mode is shown in the following table:

Number	Name/Object function	Length	Usage
78	Temperature Controller – Comfort mode	1 Bit	Activating the Comfort operating mode.

Table 31: Communication object – Comfort mode

Night mode
The "Night" operating mode should cause a significant temperature reduction/increase, e.g. at night or on weekends. The value can be freely parameterised and refers to the basic comfort value. So, if a 5K reduction has been parameterised and a basic Comfort value of 21°C has been set, the setpoint for "Night" operation mode is 16°C. In "Cooling" mode, there is a respective increase in the value.

The communication object for this operation mode is shown in the following table:

Number	Name/Object function	Length	Usage
79	Temperature Controller – Night mode	1 Bit	Activating the Night operating mode.

Table 32: Communication object – Night mode

Standby mode
The "Standby" mode is used when nobody is using the room. It should cause a slight reduction/increase in the temperature. This value should be set considerably lower than that of the "Night" operating mode to enable the room to heat up/cool down more quickly.
The value is freely configurable and refers to the basic Comfort value. So, if a setback of 2K has been parameterised and a basic Comfort value of 21°C has been set, the setpoint for "Standby" operation 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. This operation mode therefore also has no communication object.

Frost-/Heat protection mode
The "Frost protection" operating mode is activated as soon as the controller has been assigned the "Heating" function. The "Heat protection" operating mode is activated as soon as the controller has been assigned the "Cooling" function. If the controller is assigned the "Heating & Cooling" function, a combined operating mode called "Frost/Heat protection" is activated.
The "Frost/Heat protection" operating mode automatically switches on "Heating" or "Cooling" when the temperature falls below or exceeds the parameterised temperature. The temperature is parameterised here as an absolute value. If, for example, the temperature must not fall below a certain value during a longer absence, the "Frost protection" mode should be activated.

The communication object for this operation mode is shown in the following table:

Number	Name/Object function	Length	Usage
80	Temperature Controller – Frost protection mode	1 Bit	Activates the Frost protection mode
80	Temperature Controller – Heat protection mode	1 Bit	Activates the Heat protection mode
80	Temperature Controller – Frost/Heat protection mode	1 Bit	Activates the Frost/heat protection mode

Table 33: Communication objects – Frost/Heat protection

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Dead zone

If the control mode is set to "Heating and Cooling", the following parameter is displayed:

ETS-Text	Dynamic range **[Default value]**	Comment
Dead zone between Heating and Cooling	1,0 K – 10,0 K **[2,0 K]**	Setting range for the dead zone (range in which the controller activates neither the heating nor the cooling process):

Table 34: Setting – Dead zone

The settings for the dead zone are only possible if the controller type is set to “Heating and Cooling”. As soon as this setting is made, the dead zone can be parameterised.
The dead zone is the area in which the controller does not activate either the heating or cooling process. Consequently, the controller does not send any value to the control value in the dead zone and therefore the control value remains switched-off. When setting the dead zone, please note that a low value leads to frequent switching between heating and cooling, whereas 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 cooling is calculated by adding the base comfort value and the dead zone**. So, if the base comfort value is set to 21°C and the dead zone to 3K, the setpoint for the heating process is 21°C and the setpoint for the cooling process is 24°C.
The dependent setpoints for “Heating and Cooling”, i.e. those for the “Standby” and “Night” operating modes, can again be parameterised independently of each other in the controller mode “Heating and Cooling”. The setpoints are then calculated as a function of the basic Comfort value, the setpoint for the “Comfort” operating mode, for the heating and cooling process.
The setpoints for “Heat”- and “Frost protection” are independent of the settings for the dead zone and the other setpoints.

The following diagram shows again the relationship between dead zone and the setpoints for the individual operating modes:
The following settings were selected for this example:
Basic comfort value: 21°C. Dead zone between heating and cooling: 3K
Increase and reduction Standby: 2K. Increase and reduction Night: 4K

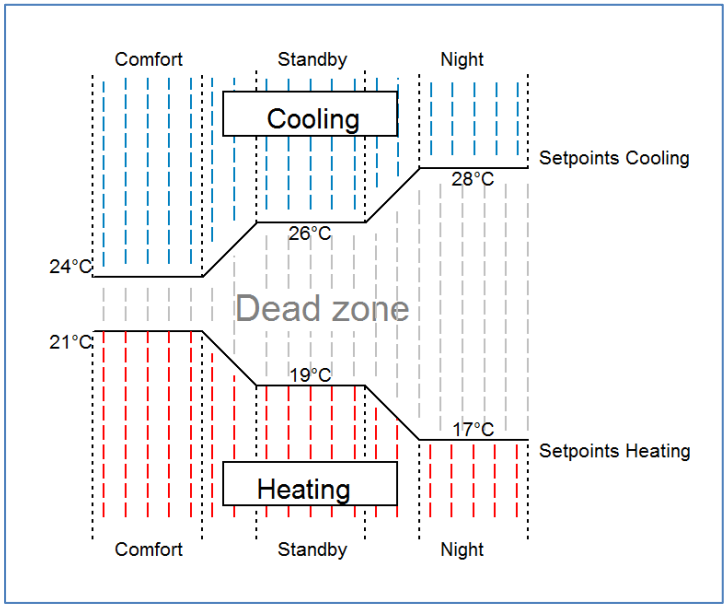

Figure 25: Example – Dead zone and corresponding setpoints

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4.4.1.2 Independent setpoints

With the "Independent setpoints" setting it is possible to specify the values for “Comfort”, “Night”, “Standby” and “Frost protection” (when in Heating mode) or “Heat protection” (in Cooling mode) independently of each other as absolute values in "°C". This means that there is no longer a reference to the Comfort setpoint.

The following table shows the corresponding settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Setpoint Heating/Cooling: Setpoint Comfort (Basic)	7 ... 35 °C **[21 °C]** **[23 °C]**	Adjustable setpoints for the operating mode described in each case. [Default values in each case Heating (top) and Cooling (bottom)]
Setpoint Standby	7 ... 35 °C **[19 °C]** **[24 °C]**	
Setpoint Night	7 ... 35 °C **[18 °C]** **[25 °C]**	
Setpoint Frost protection	3 ... 12 °C **[7 °C]**	Setpoint for Frost protection mode. **Visible when "Heating" is active.**
Setpoint Heat protection	24 ... 40 °C **[35 °C]**	Setpoint of the Heat Protection mode. **Visible when "Cooling" is active.**
Separate objects for setpoints Comfort/Standby/Night/ Frost protection/Heat protection	▪ **not active** ▪ active, single objects ▪ active, combination object (DPT 275.100)	Setting of how the setpoint value is to be specified. **Single objects are only possible for the "Heating" or "Cooling" mode!**

Table 35: Settings – Operating modes and Setpoints (independent setpoints)

Functional description:
The values for each operating mode are defined by the configuration in the ETS.
Now a new setpoint can be specified for each operating mode without affecting any other operating mode.
The setting can be done via single objects (only “Heating” or only “Cooling”) for each operating mode or as 8-byte combination object (Heating, Cooling, Heating and Cooling).
In addition, there is a general object for the setpoint setting. The setpoint that is currently active is changed via the general communication object "61 – Preset setpoint" (except for Frost/Heat protection!).

Sent values are always reported back in the same way. There is no longer a difference when switching between “Heating” and “Cooling” (no shift due to dead zone) or reduction/increase between the operating modes.

Description of the operating modes, see 4.4.1.1 Depending on setpoint Comfort (Basic)

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The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
61	Preset setpoint	2 Byte	General object for setpoint setting
62	Preset Comfort setpoint	2 Byte	Setpoint setting in Comfort mode
62	Preset (Basic) Comfort setpoint	2 Byte	Setpoint setting in Comfort mode
62	Combination object: Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when "Heating" or "Cooling"**
62	Combination object (Heating): Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when "Heating and Cooling"**
63	Preset Standby setpoint	2 Byte	Setpoint setting in Standby Mode
64	Preset Night setpoint	2 Byte	Setpoint setting in Night Mode
65	Preset Frost protection setpoint	2 Byte	Setpoint setting in Frost protection mode.
65	Preset Heat protection setpoint	2 Byte	Setpoint setting in Heat protection mode
66	Combination object (Cooling): Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when "Heating and Cooling "**

Table 36: Communication objects – Setpoint setting (independent setpoints)

4.4.1.3 Priority of the operating modes

The following table shows the possible settings for this parameter:

ETS-Text	Dynamic range **[Default value]**	Comment
Priority	▪ **Frost(Heat) protection/Comfort/Night/Standby** ▪ Frost(Heat) protection/Night/Comfort/Standby	Setting the priority order of the operating modes.

Table 37: Setting – Priority of the operating modes

The priority setting of the operating modes can be used to determine which operating mode is switched on with priority if several operating modes are selected. If, for example, comfort and night are switched on at the same time in the Frost/Comfort/Night/Standby priority, the controller remains in comfort mode until it is switched off. Then the controller automatically switches to night mode.

4.4.2 Operating mode switchover (Mode selection)

There are 2 possibilities for operating mode switchover: On the one hand, the operating mode can be controlled via the associated 1-bit communications objects and on the other hand, the operating mode can be controlled via a 1-byte object.
The selection of operating modes via 1 bit is done by direct control of the individual communication object. Considering the set priority, the operating mode controlled via its communication object is switched on or off. To switch the controller from an operation mode with higher priority to one with lower priority, the previous operation mode first must be deactivated with a logical "0". If all operation modes are switched off, the controller switches to "Standby" mode.

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Example (set priority: Frost/Comfort/Night/Standby):

Operating mode				Set 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 38: Example – Mode selection via 1 Bit

The mode selection via 1 byte is done via only one object, the DPT HVAC Mode 20.102 according to the KNX specification. For mode selection, a hex value is sent to the " mode selection" object. The object evaluates the received hex value and thus switches the associated operating mode on and the previously active operating mode off. If all operating modes are switched off (hex value = 0), the “Standby” operating mode is switched on.

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

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

Table 39: Hex values of HVAC Modes

The following example illustrates how the controller processes received hex values and thus switches operating modes on or off. The table is based on each other from top to bottom.

Example (set priority: Frost/Comfort/Night/Standby):

Received Hex value		Processing		Set operating mode
0x01		Comfort = 1		Comfort
0x03		Comfort = 0 Night = 1		Night
0x02		Night = 0 Standby = 1		Standby
0x04		Standby = 0 Frost/Heat protection = 1		Frost/Heat protection

Table 40: Example – Mode selection via 1 Byte

The controller always reacts to the last value sent. If, for example, an operating mode was last selected via a 1-bit command, the controller reacts to the switchover via 1 bit. If a hex value was last sent via the 1-byte object, the controller reacts to the switchover via 1 byte.

Important: There is no priority between switching over 1bit and 1byte!

The communication objects for the operating mode switchover are as follows:

Number	Name/Object function	Length	Usage
76	Temperature controller – Mode selection	1 Byte	Selection of operating modes
78	Temperature controller – Comfort mode	1 Bit	Activating the Comfort mode
79	Temperature controller – Night mode	1 Bit	Activating the Night mode
80	Temperature controller – Frost/Heat protection mode	1 Bit	Activating the Frost/Heat protection mode

Table 41: Communication objects – Mode selection

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4.4.3 HVAC Status objects

There are several options for visualizing the operating modes.
The following settings are available for the HVAC status objects:

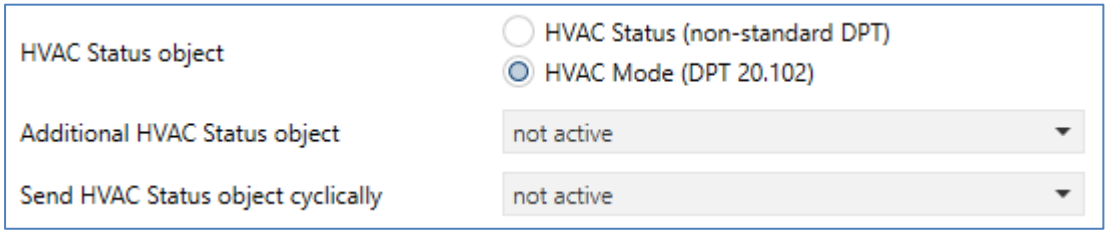

Figure 26: Settings – HVAC Status objects

The following table shows all available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
HVAC-Status object	▪ HVAC Status (non-standard DPT) ▪ **HVAC Mode (DPT 20.102)**	Specify whether the status is to be output as HVAC Status or HVAC Mode.
Additional HVAC Status object	▪ HVAC Status (non-standard DPT) ▪ HVAC Mode (DPT 20.102) ▪ RHCC Status (DPT 22.101) ▪ RTC combined status (DPT 22.103) ▪ RTSM combined status (DPT 22.107) ▪ **not active**	Setting an additional HVAC status object.
Send HVAC Status object cyclically	**not active** 5 min – 4 h	Setting whether and at what intervals the object is to be sent cyclically.

Table 42: Settings – HVAC status objects

The **HVAC Status (non-standard DPT)** according to the KNX specification sends the corresponding hex value for the currently set operating mode. If several statements apply, the hex values are added, and the status symbol then outputs the added hex value. The hex values can then be read out by a visualization.

The following table shows the hex values associated with the individual 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 43: Assignment – DPT HVAC Status

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

The **RHCC Status (DPT 22.101)** is an additional 2byte status object. It contains additional status messages. Here again, as with the HVAC object, the hex values are added for several messages and the added value is output.

The following table shows the hex values associated with the individual messages:

Bit	DPT RHCC Status		Hex-value
0	Error measuring sensor	1=Error	0x01
7	Heating/Cooling	0=Cooling/1=Heating	0x80
13	Frost alarm	1=Frost alarm	0x2000
14	Heat alarm	1=Heat alarm	0x4000

Table 44: Assignment – DPT RHCC Status

With the RHCC Status, various error messages or basic settings can therefore be displayed or requested.

RTC combined status (DPT 22.103)

This is a combined status according to DPT 22.103.
The assignment is as follows:

Bit	Beschreibung / Description	Codierung / Encoding
0	Allgemeiner Fehler General failure information	0=kein Fehler/no failure 1=Fehler/failure
1	Aktiver Mode Active mode	0=Kühlen/Cool mode 1=Heizen/Heat mode
2	Taupunkt Status Dew point status	0=kein Alarm/no alarm 1=Alarm (RTC gesperrt)/alarm (RTC locked)
3	Frost Alarm Frost Alarm	0=kein Alarm/no alarm 1=Alarm/alarm
4	Hitze Alarm Overheat-Alarm	0=kein Alarm/no alarm 1=Alarm/alarm
6	Zusätzliche Heiz-/Kühlstufe (2. Stufe) Additional heating/cooling stage (2. Stage)	0=Inaktiv/inactive 1=Aktiv/active
7	Heizmodus aktiviert Heating mode enabled	0=Falsch/false 1=Wahr/true
8	Kühlmodus aktiviert Cooling mode enabled	0=Falsch/false 1=Wahr/true

Table 45: Assignment – RTC combined status DPT 22.103

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RTSM combined status (DPT 22.107)

This is a combined status according to DPT 22.107. The assignment is as follows:

Bit	Beschreibung / Description	Codierung / Encoding
0	Effektiver Wert des Fensterstatus Effective value of the window status	0 = alle Fenster geschlossen/ all windows closed 1 = mindestens ein Fenster geöffnet/ at least one window opened
1	Effektiver Wert des Präsenzstatus Effective value of the presence status	0 = keine Meldung einer Präsenz/ no occupancy from presence detectors 1 = mindestens ein Melder belegt/ occupancy at least from one presence detector
3	Status der Komfortverlängerung Status of comfort prolongation User	0 = Komfortverlängerung nicht aktiv/ comfort prolongation User not active 1 = Komfortverlängerung aktiv/ comfort prolongation User not active

Table 46: Assignment – RTSM combined status DPT 22.107

4.4.4 Operating mode after reset

The following table shows all available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Operating mode after reset	▪ **Comfort with configured setpoint** ▪ Standby with configured setpoint ▪ Hold previous state and setpoint	Setting which operating mode or behaviour is to be activated after a bus voltage return.
Operating mode after reprogramming	▪ **Comfort** ▪ Standby	Setting the operating mode after reprogramming. **Only with the setting "Hold previous state and setpoint".**

Table 47: Settings – Operating mode after reset

- **Comfort with configured setpoint**
  After a bus voltage return, the comfort is activated with the setpoint that was specified by the ETS.
- **Standby with configured setpoint**
  After a bus voltage return, the Standby mode is activated with the setpoint that was specified by the ETS (Comfort setpoint minus Standby reduction).
- **Hold previous state and setpoint**
  The temperature controller recalls the setpoint and mode that was set before the bus was switched off. With this selection, the parameter "**Operating mode after reprogramming**" can be used to additionally set which operating mode is active after reprogramming.

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4.4.5 Setpoint shift

The following table shows all available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Maximum setpoint shift	0 ... 10 K **[3 K]**	Setting the maximum setpoint shift.
Setpoint shift via 1Bit/1Byte object	▪ **not active** ▪ 1 Bit ▪ 1 Byte	Setting whether setpoint shift is to be activated via 1 bit or 1 byte.
Step width	0,1 K – 1 K **[0,5 K]**	Setting of the step width for the setpoint shift via 1 Bit/1 Byte. **Only visible if setpoint shift via 1 Bit/1 Byte is active**.
Status setpoint shift	▪ **not active** ▪ active	Activation of an object to send the current state of the setpoint shift.
Setpoint shift applies to	▪ **Comfort** ▪ Comfort/Night/Standby	Validity range of the setpoint shift.
Action if shift during Night/Standby	▪ **no action** ▪ change to Comfort	Setting whether to switch back to comfort after a shift during Night/Standby. **Only visible if setpoint shift is only active for Comfort**.
Delete setpoint shift after change of operating mode	▪ **not active** ▪ active	Setting whether the current setpoint shift is to be deleted after a change of operating mode or not.
Delete setpoint shift after new basic setpoint	▪ not active ▪ **active**	Setting whether the current setpoint shift should be deleted or not after a new absolute setpoint has been specified. **Only visible when "independent setpoints" is selected.**
Delete setpoint shift after new basic setpoint	▪ not active ▪ **active**	Setting whether the current setpoint shift should be deleted or not after a new basic setpoint has been specified. **Only visible if "depending on setpoint Comfort (Basic)" is selected.**
Reset basic setpoint to configured value after operation mode change	▪ not active ▪ **active**	Setting whether the base setpoint should be reset to the configured basic setpoint after an operating mode change. **Only visible if "depending on setpoint Comfort (Basic)" is selected**.
Send setpoint change	▪ not active ▪ **active**	Setting whether a change of the setpoint value should be sent.
Send current setpoint cyclically	**not active** 5 min – 4 h	Setting whether and at what intervals the object is to be sent cyclically.

Table 48: Settings – Setpoint shift

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Setpoint shift
The basic comfort setpoint is permanently configured via the ETS. This setpoint can be changed in two ways. On the one hand, a new absolute setpoint can be specified for the controller - this is done via the communication object "(Basic) Comfort setpoint" as a 2-byte absolute value. On the other hand, the preset setpoint can be raised or lowered manually. This is done via the "manual setpoint shift" objects, optionally via 1 bit, 1 byte or 2 bytes.
With the setpoint shift, the currently set setpoint is shifted as a temperature difference. The "manual setpoint shift" object is used for this. With the 1-byte / 2-byte object, a positive Kelvin value is sent to the controller to increase the temperature or a negative Kelvin value to decrease it. With the manual setpoint shift via the 1-bit object, only on/off commands are sent, and the controller raises the setpoint by the set increment when it receives a "1" and lowers the setpoint by the set increment when it receives a "0".
The setpoint shift over 2byte is automatically active for the controller, the corresponding communication object 68 is permanently displayed. The shift over 1 bit/1 byte can be activated via parameters.
When the setpoint is shifted, the configured basic comfort value is not changed as a reference value for the other operating modes!

The maximum manual shift of the setpoint can be limited via the "**Maximum setpoint shift**" setting. If, for example, the controller is set to a basic comfort value of 21°C and a max. setpoint shift of 3K, the basic comfort value can only be manually shifted within the limits of 18°C to 24°C.

Activating the "**Status setpoint shift**" creates a further object. This can be used to send the current status of the setpoint shift. This is important for some visualizations for their correct function.

The "**Setpoint shift applies to**" setting can be used to set whether the shift only applies to the comfort mode or whether the setting should also be adopted for the Night and Standby operating modes. The Frost/Heat protection operating modes are in any case independent of the setpoint shift.

The setting "**Delete setpoint shift after change of operating mode**" can be used to set whether the new setpoint should be retained after a change of operating mode or whether the controller should return to the value configured in the ETS software after a change of operating mode.

Delete setpoint shift after new absolute setpoint means that the setpoint shift is always deleted as soon as a new setpoint is assigned via object.

Delete setpoint shift after new basic setpoint value has the effect that after a new basic setpoint value has been specified as an absolute value, the setpoint shift that has taken place is deleted and is started with the new setpoint value.

Reset basic setpoint to configuration after change of operating mode causes the setpoint to be reset to the configured basic value after each change of operating mode.

If the parameter "**Send setpoint changes**" is activated, the new, now valid setpoint is sent on the bus via the communication object "Current setpoint" with each change.

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When a new absolute comfort setpoint is read in, a new basic comfort value is assigned to the controller. There is a significant difference in the Smart room temperature controller between the settings "dependent on comfort setpoint (basic)" and "independent setpoints".

Setting "depending on setpoint Comfort (Basic)".
This new basic comfort value (object “62”) also automatically causes an adjustment of the dependent setpoints in the other operating modes, as these are relative to the basic comfort value. All settings for setpoint shifting do not apply here, as a completely new base value is assigned to the controller.
The specification of a setpoint via the communication object "61 - Setpoint setting" offers a special feature. Here the new value is written to the basic comfort setpoint, a valid setpoint shift is deleted and the controller automatically jumps to comfort, regardless of which mode the controller was in before. This procedure is required for visualizations that make changes via absolute setpoints. This ensures that the new setpoint sent is also reported back.

Setting "Independent setpoints".
Here, an individual absolute value can be specified for each operating mode. If, for example, the setpoint is changed in Comfort mode (object "62"), the other setpoints remain unaffected.
A special feature is the common object "61 - setpoint setting". This always changes the setpoint in the currently valid mode. If, for example, the controller is currently in Standby mode and the value "20°C" is sent via object "61", the Standby setpoint is changed to "20°C" at this moment.

The following table shows the communication objects relevant for the setpoint change:

Number	Name/Object function	Length	Usage
61	Preset setpoint	2 Byte	General object for setpoint setting
62	Preset Comfort setpoint	2 Byte	Setpoint setting in Comfort mode
62	Preset (Basic) Comfort setpoint	2 Byte	Setpoint setting in Comfort mode
62	Combination object: Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when "Heating" or "Cooling"**
62	Combination object (Heating): Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when "Heating and Cooling"**
63	Preset Standby setpoint	2 Byte	Setpoint setting in Standby Mode
64	Preset Night setpoint	2 Byte	Setpoint setting in Night Mode
65	Preset Frost protection setpoint	2 Byte	Setpoint setting in Frost protection mode.
65	Preset Heat protection setpoint	2 Byte	Setpoint setting in Heat protection mode
66	Combination object (Cooling): Preset setpoint	8 Byte	Setpoint setting via combined object. **Visible when “Heating and Cooling “**
67	Send current setpoint	2 Byte	Outputs the currently valid setpoint
68	Manual setpoint shift (2Byte)	2 Byte	Shift of the setpoint relative to the preset comfort setpoint. Object is permanently displayed
69	Manual setpoint shift (1=+ / 0=-)	1 Bit	Increase/decrease the setpoint relative to the preset comfort setpoints by the set step width
69	Manual setpoint shift (1Byte)	1 Byte	Increase/decrease the setpoint relative to the preset comfort setpoints by the set step width
70	Send status setpoint shift	2 Byte	Sending the current status of the setpoint shift

Table 49: Communication objects – Setpoint changes

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4.4.6 Comfort extension with time

The comfort extension causes a temporary switching to “Comfort” mode.
The following parameters are available for this:

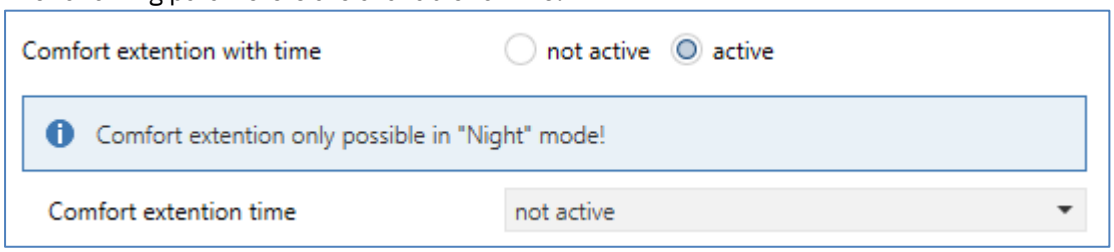

Figure 27: Settings – Comfort extension with time

The following table shows the setting options for this parameter:

ETS-Text	Dynamic range **[Default value]**	Comment
Comfort extension with time	▪ **not active** ▪ active	Activation of the Comfort extension via time-dependent object.
Comfort extension time	**not active** 30 min, 1 h, 1,5 h, 2 h, 2,5 h, 3 h, 3,5 h, 4 h	Adjustable time for Comfort Extension.

Table 50: Settings – Comfort extension with time

If the comfort extension is activated, the following communication object appears:

Number	Name/Object function	Length	Usage
77	Comfort operating mode: Comfort extension	1 Bit	Temporary switching to Comfort mode via object for the duration of a predefined time

Table 51: Communication object – Comfort extension with time

The comfort extension can be used, for example, to extend the “Comfort” mode for visits, parties, etc. If, for example, a timer switches the channel to “Night” mode at a certain time, it can be switched back to “Comfort” mode for a certain time by means of the Comfort extension. When a “1” is sent to the object “Comfort extension”, the channel switches from “Night” mode back to “Comfort” mode for the set "Comfort extension time". After the "Comfort extension time" has elapsed, the channel automatically switches back to “Night” mode. If the “Comfort extension” is to be ended before the time has expired, this can be achieved by sending a “0” to the object.
If a “1” is sent to the object again during the Comfort extension, the set time is restarted.
If the mode is changed during the extension, the time is stopped.

The Comfort extension only works for switching from “Night” to “Comfort” mode and back!

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4.4.7 Lock objects

The following table shows all available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Lock object: Control value Heating	▪ **not active** ▪ active	Activates the lock object for the heating process.
Lock object: Control value Cooling	▪ **not active** ▪ active	Activates the lock object for the cooling process.

Table 52: Settings – Lock objects for control value

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 would be manual locking, for example in the event of a cleaning process. The lock object locks the control value as soon as a “1” is sent to the associated communication object. The lock is cancelled with a “0”.

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
89	Lock object Heating: Lock control value	1 Bit	Locks the control value in Heating mode
90	Lock object Cooling: Lock control value	1 Bit	Locks the control value in Cooling mode

Table 53: Communication objects – Lock objects for control value

4.4.8 Object for Heating/Cooling request

The following table shows the available settings:

ETS-Text	Dynamic range **[Default value]**	Comment
Object for Heating request	▪ **not active** ▪ active	Activates an object to indicate whether a heating request is present or not.
Object for Cooling request	▪ **not active** ▪ active	Activates an object to indicate whether a cooling request is present or not.

Table 54: Settings –Objects for Heating/Cooling request

The setting "Object for request Heating/Cooling" allows objects to be displayed that indicate an active heating or cooling process. The objects can be used for a visualisation. For example, a red LED could indicate an ongoing heating process and a blue LED could indicate an ongoing cooling process. Another possible 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 are switched on as soon as a controller issues the request for heating. The object outputs a “1” as long as the respective process continues. When the process is finished, a “0” is output.

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
95	Send Heating request	1 Bit	Indicates an active/inactive heating process
96	Send Cooling request	1 Bit	Indicates an active/inactive cooling process

Table 55: Communication objects – Objects for Heating/Cooling request

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4.4.9 Reference via outdoor temperature

Important: This parameter is only available for the operating mode "Cooling"!

The following settings are available:

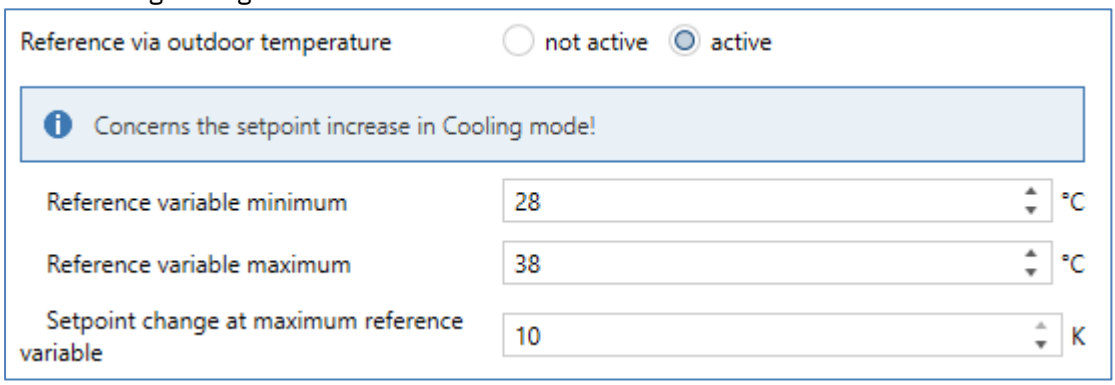

Figure 28: Settings – Reference via outdoor temperature

The following table shows the setting options for this parameter:

ETS-Text	Dynamic range **[Default value]**	Comment
Reference via outdoor temperature	▪ **not active** ▪ active	Activation of the parameter. **Only available in Cooling mode**!
Reference variable minimum	10 ... 60 °C **[28°C]**	Lower respectively upper response value of the reference control.
Reference variable maximum	10 ... 60 °C **[38°C]**	
Setpoint change at maximum reference variable	1 ... 10 K **[10 K]**	Change of the setpoint when the maximum reference variable is reached.

Table 56: Settings – Reference via outdoor temperature

General description of the functionality of the "Reference control":

The "**Reference control**" parameter makes it possible to linearly track the setpoint as a function of any reference variable, which is recorded via an external sensor. With appropriate configuration, a continuous increase or decrease of the setpoint can be achieved.
To determine the extent to which reference control affects the setpoint, three settings must be made: **Minimum reference variable** (w_{min}), **maximum reference variable** (w_{max}), and the **setpoint change at maximum reference variable** ($\triangle X$).
The settings for the reference variable maximum (w_{max}) and minimum (w_{min}) describe the temperature range in which the reference variable begins and ends to influence the setpoint. The setpoint change at maximum reference variable ($\triangle X_{max}$) describes the ratio of how strongly an increase in the reference temperature affects the setpoint. The actual setpoint change then results from the following relationship:

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

If the reference control is to be increased, a positive value must be set for the "setpoint change at maximum reference variable" (Cooling mode). If, on the other hand, a setpoint reduction is desired, the "setpoint change at maximum command value" must be set to a negative value (Heating mode). The setpoint change $\triangle X$ is then added to the basic comfort value.

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A value above or below the reference value has no effect on the setpoint change. As soon as the value is within the reference variable (i.e. between w_{max} & w_{min}), the setpoint is lowered or raised.

The following graphics are intended to illustrate the influence of the reference variable on the setpoint:
(Xsoll=new setpoint; Xbasis=base setpoint)

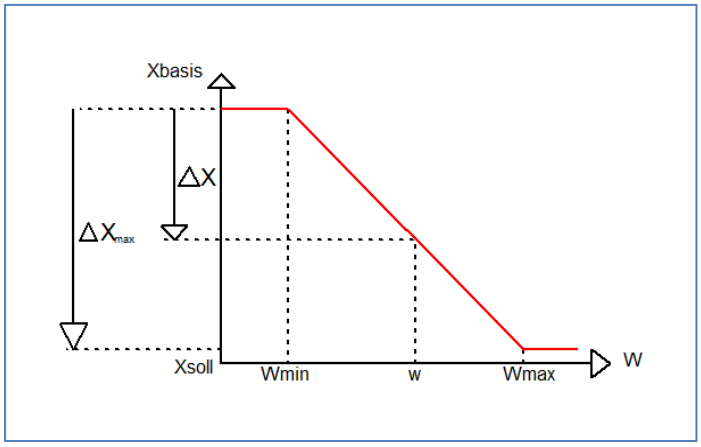

Figure 29: Example – Reference control/decrease

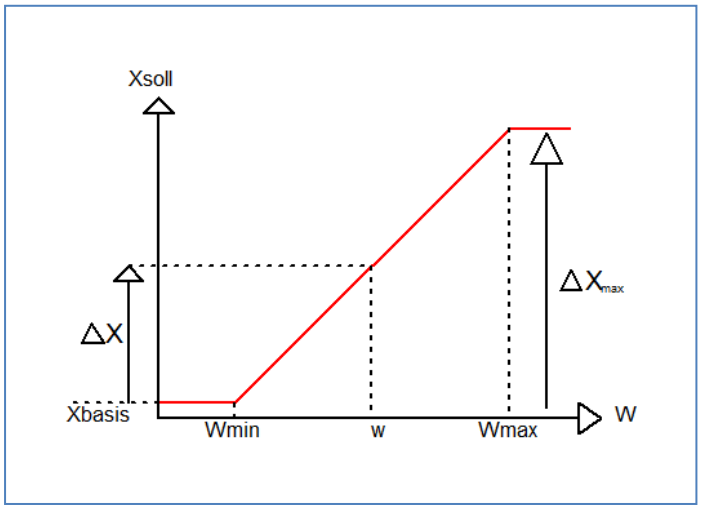

Figure 30: Example – Reference control/increase

With the communication object of the reference value, the current temperature of the external sensor can be read out. The communication object does not have to be linked with the communication object of the setpoints to activate the command but is only used to request the reference temperature.

The following table shows the corresponding object:

Number	Name/Object function	Length	Usage
97	Outside temperature – Receive measured value/Reference value	2 Byte	Receiving an external measured value as a reference variable

Table 57: Communication object – Reference via outdoor temperature

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Example of use (guided via outdoor temperature):
For the temperature control of a room, the setpoint (22°C) should be raised so that in an outdoor temperature range of 28°C to 38°C the temperature difference between outdoor and indoor temperature does not exceed 6K.

Settings to be made:
Basic comfort value: 22°C Reference control: active
Minimum reference variable: 28°C Maximum reference variable: 38°C
Setpoint change at maximum reference variable: 10°C

If the outdoor temperature were to rise to 32°C, the setpoint would be increased by the following value: △X = 10°C * [(32°C-28°C)/(38°C-28°C)] = 4°C.
This would result in a new setpoint of 22°C+4°C=26°C.
If the outdoor temperature reaches the set maximum value of 38°C, the setpoint would be 32°C and would not increase any further if the temperature continues to rise.

4.4.10 Flow temperature limitation

Important: This parameter is only available in the "Heating" mode!

The following parameter activates the flow temperature limitation:

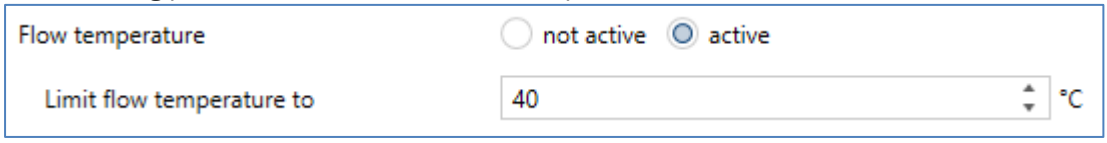

Figure 31: Settings – Flow temperature limitation

The following settings are available:

ETS-Text	Dynamic range **[Default value]**	Comment
Flow temperature	▪ **not active** ▪ active	Activation of the flow temperature limitation.
Limit flow temperature to	10 ... 60 °C **[40 °C]**	Setting of the value to which the flow temperature is to be limited.

Table 58: Settings – Flow temperature limitation

With this setting, the current flow temperature can be limited. This makes it possible to limit the heating temperature as required in certain situations. If, for example, an underfloor heating system is not to heat above a certain value to protect the floor coverings, the heating temperature can be limited by the flow temperature limitation.
The flow temperature limitation requires a second sensor on the flow itself. This sensor measures the current flow temperature. The object that measures the flow temperature is then connected in a group address with the object for the flow temperature of the temperature controller. This then limits the flow temperature according to the set parameters.

The following communication object is available:

Number	Name/Object function	Length	Usage
85	Temperature controller – Receive flow temperature Heating	2 Byte	Receiving the measured flow temperature

Table 59: Communication object – Flow temperature limitation

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4.4.11 Alarms

By means of the alarm function, the falling below or exceeding of a set temperature can be indicated via its associated communication objects:

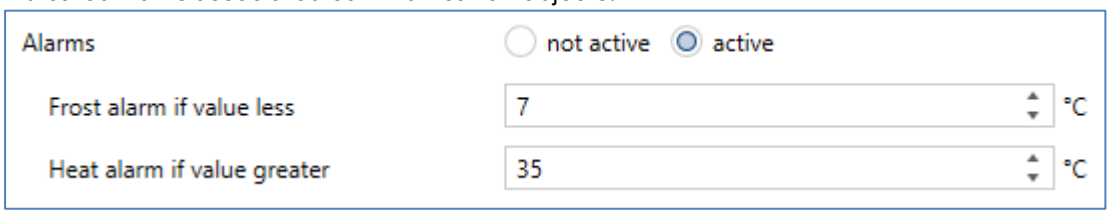

Figure 32: Settings – Alarms

The setting options for this parameter are shown in the table below:

ETS-Text	Dynamic range **[Default value]**	Comment
Alarms	▪ **not active** ▪ active	Activation of the alarms for Frost or Heat
Frost alarm if value less	3 ... 10°C **[7°C]**	Setting of the lower indication value. **Only available if "Alarms" is activated.**
Heat alarm if value greater	25 ... 40 °C **[35°C]**	Setting of the upper indication value. **Only available if "Alarms" is activated.**

Table 60: Settings – Alarms

The alarm function reports the falling below or exceeding of an adjustable temperature via the associated object. Falling below the lower indication value is reported via the Frost alarm object. Exceeding the upper indication value is reported via the heat alarm object. The two signalling objects of size 1 Bit can be used for visualisation or for initiating countermeasures. If the lower indication value is exceeded again or the upper indication value is fallen short of again, a "0" is sent in each case and thus the alarm is cancelled.

The following table shows the two objects:

Number	Name/Object function	Length	Usage
83	Temperature controller – Send Frost alarm	1 Bit	Reports falling below the lower indication value
84	Temperature controller – Send Heat alarm	1 Bit	Reports the exceeding of the upper indication value

Table 61: Communication objects – Alarms

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4.4.12 Window contact

The following settings are available for this parameter:

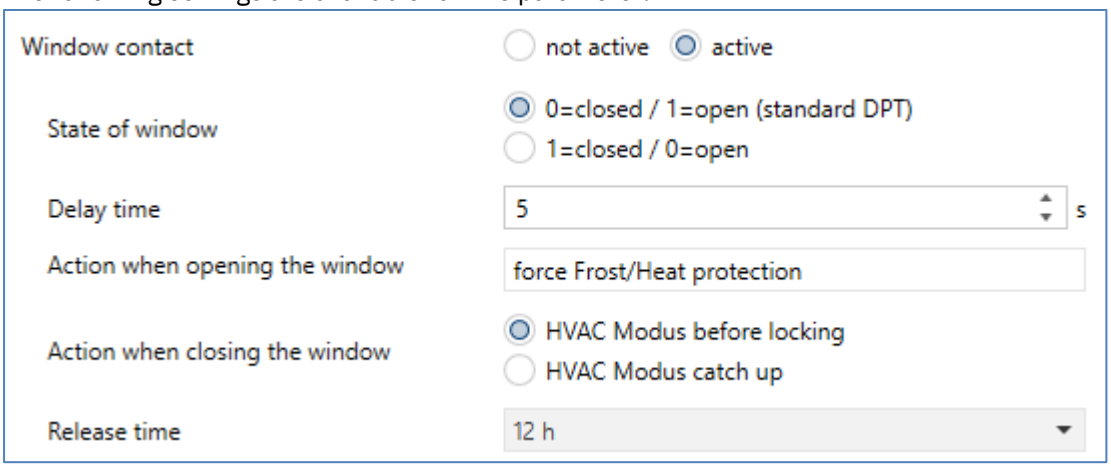

Figure 33: Settings – Window contact

The setting options for this parameter are shown in the table below:

ETS-Text	Dynamic range **[Default value]**	Comment
Window contact	▪ **not active** ▪ active	Setting whether window contact is monitored or not.
State of window	▪ **0=closed / 1=open (standard DPT)** ▪ 1=closed / 0=open	Setting the polarity with which value the window is open/closed.
Delay time	0 ... 240 s **[5 s]**	Setting of a time by which the switching is delayed after opening/closing the window.
Action when opening the window	force Frost-/Heat protection	Fixed text. Not changeable.
Action when closing the window	▪ **HVAC Modus before locking** ▪ HVAC Modus catch up	Specify whether to switch to the mode before the lock after closing the window or to a new mode changed during the lock.
Release time	not active (not recommended) 1 h – 24 h **[12 h)]**	Setting after which time the unit automatically switches back to the previous mode.

Table 62: Settings – Window contact

With this function, the control in a room can be forced into frost or heat protection after opening a window. Normal Heating/Cooling operation is thus interrupted for a long time. This prevents, for example, that energy is unnecessarily consumed for heating after opening a window in winter. After closing the window, it is then possible to switch back to normal operation.

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The "**Delay time**" has the effect that the action to be carried out after opening/closing the window only takes place after a configurable time. This means that a short opening of the window can be carried out without influencing the control.

With "**Action when closing the window**" it can be set whether after closing, the window returns to the mode before the lock or in the mode that, for example, was sent during the lock as from a timer or a visualization.

The "**Release time**" defines the time after which the controller automatically returns to the previous operating mode after the window has been opened. This is useful if, for example, you forget to close the window again. In this case, the room would be prevented from cooling down in winter or overheating in summer.

The following table shows the associated communication object:

Number	Name/Object function	Length	Usage
88	Temperature controller – Window contact – 0=closed / 1=open / 1=closed / 0=open	1 Bit	Receiving the current window status. Polarity depending on parameter setting.

Table 63: Communication object – Window contact

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4.4.13 Diagnosis

The diagnosis function outputs the status of the controller in "plain text" and is used to quickly read out the current device status.

Communication **object 87 "Temperature controller – Diagnosis status"** is used for the output. This is permanently displayed and sends automatically with every change.

The following messages can be sent out by the diagnosis function:

	Byte 0-1	**Byte 3**	**Byte 5-11**	**Byte 13**
Info		Heating/Cooling	Operation mode	Control value > 0%, if „yes“: Value 1
Possible messages		Heating: H	Comfort	Control value = 0%: 0
		Cooling: C	Standby	Control value > 0%: 1
			Night	
			Frost	
			Heat	
			ComProl – Comfort prolongation active	
			Window - Window contact active	
			BIT – Channel operating mode switching 1 Bit	
			PWM BYTE – Channel operating mode continuous 1 Byte	
Special messages	Locked	Channel is locked		
	Contr Flowtemp	Control value reduced by flow temperature		
	Contr Dewpoint	Control value reduced by dew point		
	Setpoint Guide	Control value reduced by outdoor temperature/reference variable		
	Dew point alarm	The dew point alarm is active		

Table 64: Overview – Diagnosis text

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4.5 Controller parameter

The output of the control variable is defined with the setting of the control value. Depending on this setting, the other setting options are displayed.

The following table shows the setting options for this parameter:

ETS-Text	Dynamic range **[Default value]**	Comment
Control value	▪ **PI control continuous** ▪ PI control switching (PWM) ▪ 2-step control (switching)	Defines the control after which the control value is output.

Table 65: Settings – Control value (Type of controller)

The temperature controller has three different types of controllers that determine the control value. The further configuration options depend on the controller type used.

The following table shows the available communication objects:

Number	Name/Object function	Length	Usage
71	Temperature controller – Control value Heating: Send control value	1 Byte 1 Bit	Controlling the actuator for the heating process. DPT depending on the set parameter.
71	Temperature controller – Control value Heating/Cooling: Send control value	1 Byte 1 Bit	Controlling the actuator for the heating and cooling process. DPT depending on the set parameter. Available for the "2-pipe / 1-circuit" system.
72	Temperature controller – Control value Cooling: Send control value	1 Byte 1 Bit	Controlling the actuator for the cooling process. DPT depending on the set parameter.

Table 66: Communication objects – Control value

Depending on the controller type set, the control value controls the heating and/or cooling process. If the control value is selected as a continuous PI control, the communication object for the control value is a 1Byte object, as the control value can assume several states. If the control value is selected as 2-point control or as PWM control, the communication object is a 1Bit object, as the control value can only assume 2 states (0; 1).

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4.5.1 PI-control continuous

If the control value is selected as continuous PI control, the following setting options are available (here: operating mode “Heating”):

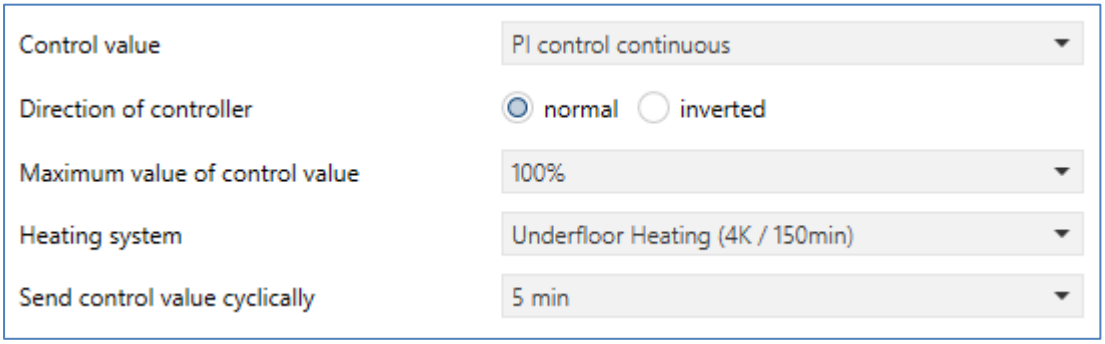

Figure 34: Settings – PI control continuous

The following table shows the possible settings for continuous PI control:

ETS-Text	Dynamic range **[Default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Specifies the control behaviour with rising temperature.
Maximum value of control value	**100%**; 90%; 80%; 75%; 70%; 60%; 50%; 40%; 30%; 25%; 20%; 10%; 0%	Specifies the output power of the control value in maximum operation.
Heating system	▪ **Water heating (4K / 120 min)** ▪ Underfloor heating (4K / 150 min) ▪ Split Unit (4K / 60min) ▪ Adjustment via control parameter	Setting of the heating system used. Individual parameterization possible via setting 4.
Cooling system	▪ **Split Unit (4K / 60 min)** ▪ Cooling ceiling (4K / 150 min) ▪ Adjustment via control parameter	Setting of the cooling system used. Individual parameterization possible via setting 3.
Proportional range	1 K - 20 K **[4 K]**	**Only visible with setting "Adjustment via control parameters**". Here the proportional band can be set freely.
Reset time	15 min – 240 min **[150 min]**	**Only visible with setting "Adjustment via control parameters**". The integral range can be freely adjusted here.
Send control value cyclically	not active, 1 min, 2 min, 3 min, 4 min, **5 min**, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, 60 min	Activation of cyclical sending of the control value with setting of the cycle time.

Table 67: Settings – PI control continuous

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PI control is a continuous control with a proportional component, the “P component” and an integral component, the “I component”. The size of the P component is specified in K (Kelvin).
The I component is referred to as reset time and is specified in min (minutes).
The control value for continuous PI control is controlled in steps from 0% up to the set maximum value of the control value.

Maximum value of control value
With this setting, the control value to be output can be limited. To prevent switching operations with too high control values, the parameter can be set to a fixed value so that the actuator does not exceed this maximum value.

Heating/ Cooling system
The individual control parameters, P-component and I-component are set by adjusting the heating/cooling system used. It is possible to use preset values which are suitable for certain heating or cooling systems or to freely parameterize the P-controller and I-controller components. The preset values for the respective heating or cooling system are based on empirical values proven in practice and usually lead to good control results.

If a free "**adjustment via control parameters**" is selected, the proportional band and reset time can be freely set.

Important: This setting requires sufficient knowledge in the field of control engineering!

Proportional range
The proportional band stands for the P-component of a control. The P-component of a control system leads to a proportional increase of the control value to the system deviation.
A small proportional band leads to a fast correction of the system deviation. With a small proportional band, the controller reacts almost abruptly and sets the control value almost to the maximum value (100%) even with small control differences. However, if the proportional band is selected too small, the risk of overshooting is very high.
A proportional band of 4K sets the control value to 100% with a control deviation (difference between setpoint and current temperature) of 4°C. Thus, with this setting, a control deviation of 1°C would result in a control value of 25%.

Reset time
The reset time represents the I-component of a regulation. The I-component of a regulation leads to an integral approximation of the process value to the setpoint. A short reset time means that the controller has a large I-component.
A small reset time causes the control value to quickly approach the control value set according to the proportional band. A large reset time, on the other hand, causes the output variable to approach this value slowly.
When making the setting, please note that a reset time that is set too small could cause overshooting. In principle, the larger the reset time, the slower the system.

Send control value cyclically
With the aid of the parameter "Send control value cyclically" it can be set whether the channel should send its current status at certain intervals. The time intervals between two transmissions can also be parameterised.

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4.5.2 PI control switching (PWM)

The following setting options are available (here: operating mode “Heating”):

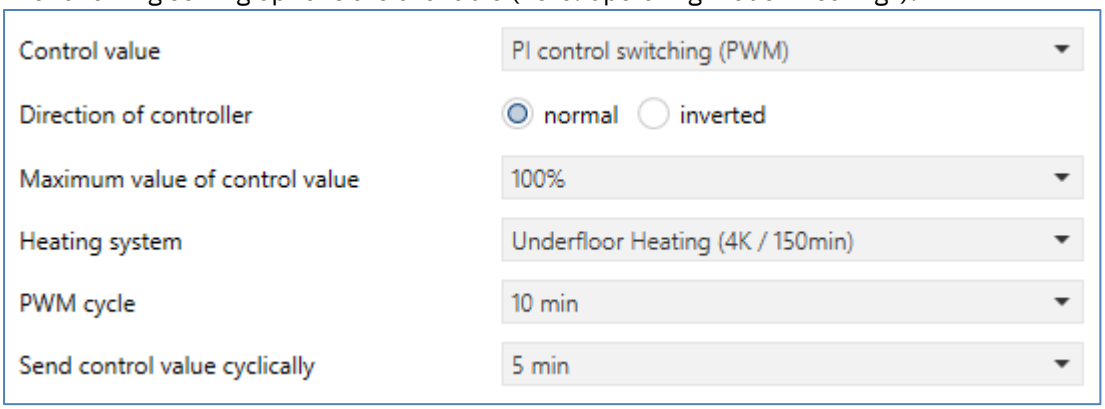

Figure 35: Settings – PI control switching (PWM)

The PWM control is a further development of the PI control. All settings possible for PI control can also be made here. In addition, the PWM cycle time can be set.

The following table shows the settings for switching PI control:

ETS-Text	Dynamic range **[Default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Specifies the control behaviour with rising temperature.
Maximum value of control value	**100%**; 90%; 80%; 75%; 70%; 60%; 50%; 40%; 30%; 25%; 20%; 10%; 0%	Specifies the value of the control value in maximum operation.
Heating system	▪ **Water heating (4K / 120 min)** ▪ Underfloor heating (4K / 150 min) ▪ Split Unit (4K / 60min) ▪ Adjustment via control parameter	Setting the heating system used. Individual configuration possible via setting 4.
Cooling system	▪ **Split Unit (4K / 60 min)** ▪ Cooling ceiling (4K / 150 min) ▪ Adjustment via control parameter	Setting of the cooling system used. Individual configuration possible via setting 3.
Proportional range	1 K - 20 K **[4 K]**	**Only with setting "Adjustment via control parameters**". Here the proportional band can be set freely.
Reset time	15 min – 240 min **[150 min]**	**Only with setting "Adjustment via control parameters**". The integral range can be freely adjusted here.
PWM cycle	1 – 30 min **[10 min]**	Setting the PWM cycle time. Includes the total time of a switch-on and switch-off pulse.
Send control value cyclically	not active, 1 min, 2 min, 3 min, 4 min, **5 min**, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, 60 min	Activation of cyclical sending of the control value with setting of the cycle time.

Table 68: Settings – PI control switching (PWM)

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In PWM control, the controller switches the control value according to the value calculated in PI control, considering the cycle time. The control value is thus converted into pulse width modulation (PWM).

PWM cycle
The PWM cycle is used for PWM control to calculate the switch-on and switch-off pulse of the control value. This calculation is based on the calculated control value. A PWM cycle comprises the total time from the switch-on point to the new switch-on point.

Example:
If a control value of 75% is calculated with a set cycle time of 10 minutes, the control value is switched on for 7.5 minutes and switched off for 2.5 minutes.

In principle, the slower the overall system, the longer the cycle time can be set.

Important: For PI control switching (PWM), the status can also be output as a percentage value.

The following communication objects are available for this:

Number	Name/Object function	Length	Usage
73	Temperature controller – Control value Heating: Send status	1 Byte	Sends the status as a percentage value
73	Temperature controller – Control value Heating/Cooling: Send status	1 Byte	Sends the status as a percentage value
74	Temperature controller – Control value Cooling: Send status	1 Byte	Sends the status as a percentage value

Table 69: Communication objects – Status control value

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4.5.3 2-step control (switching)

The following setting options are available for this (here: operating mode “Heating”):

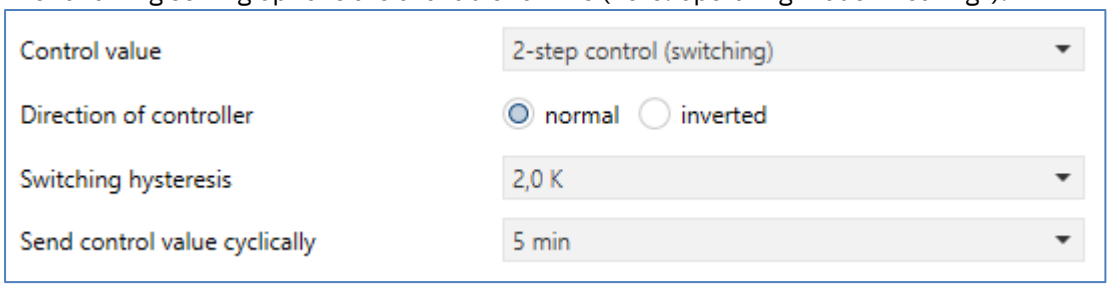

Figure 36: Settings – 2-step control (switching)

The following table shows the possible settings for 2-step control:

ETS-Text	Dynamic range **[Default value]**	Comment
Direction of controller	▪ **normal** ▪ inverted	Specifies the control behaviour when the temperature rises. Adaptation to normally opened valves.
Switching hysteresis	0,5 K – 5,0 K **[2,0 K]**	Setting for upper and lower switch-on and switch-off point.
Send control value cyclically	not active, 1 min – 60 min **[5 min]**	Setting whether and at what interval the control value is sent cyclically.

Table 70: Settings – 2-step control (switching)

The 2-step 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 reference temperature and switches it off again when the temperature exceeds a certain reference temperature.
The switch-on and switch-off points, i.e. where the reference temperature is, depend on the currently adjusted set point and the adjusted switching hysteresis.
The 2-step controller is used when the control value can only assume two states, e.g. an electro-thermal valve.

Switching hysteresis
The setting of the switching hysteresis is used by the controller to calculate the switch-on and switch-off point. This is done considering the currently valid setpoint.

Example: In the controller, with mode “Heating”, a basic comfort value of 21°C and a hysteresis of 2K are set. In the Comfort mode, this results in an activation temperature of 20°C and a deactivation temperature of 22°C.

When making the setting, please note that a large hysteresis leads to a large fluctuation of the actual room temperature. However, a small hysteresis can cause the control value to be switched on and off permanently, as the switch-on and switch-off points are close together.

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4.5.4 Direction of controller

The direction of controller describes the response of the control value to a change in the system deviation as the temperature rises. The control value can exhibit normal control response to a rising temperature or inverted control response. The direction of action is available for all settings of the control value (PI control; PWM; 2-step).
In PWM and 2-step control, an inverted control value is used for adaptation to valves that are open when no current is applied.
For the individual controllers, an inverted correcting variable, here in the example for operating mode “Heating”, means:

- **PI-controller**
  The control value decreases with increasing system deviation and increases with decreasing system deviation.
- **PWM-controller**
  The ratio of the duty cycle to the total PWM cycle increases with rising temperature and decreases with falling temperature.
- **2-step-controller**
  The controller switches itself on at the actual switch-off point and off at the actual switch-on point.

4.5.5 Additional settings for Heating & Cooling mode

The picture shows the additional settings in “Heating and Cooling” mode:

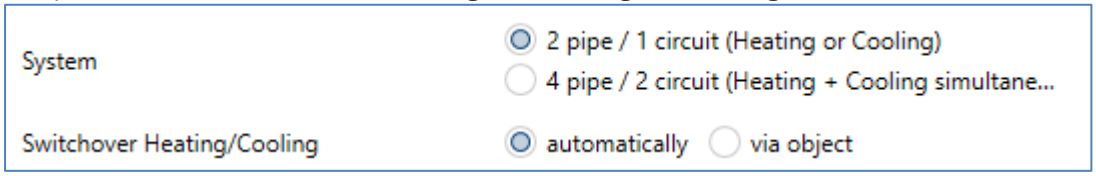

Figure 37: Additional settings – Heating and Cooling

The following table shows the additional settings in the "Heating and Cooling" operating mode:

ETS-Text	Dynamic range **[Default value]**	Comment
System	▪ **2 pipe / 1 circuit (Heating or Cooling)** ▪ 4 pipe / 2 circuit (Heating + Cooling simultaneously)	Setting for separate or combined heating / cooling circuits.
Switchover Heating/Cooling	▪ **automatically** ▪ via object	Setting whether the switchover is carried out automatically via the temperature or via a separate object. Only with controller setting "**Setpoints - dependent on setpoint Comfort (Basic)”.**
	via object	Fixed text, not changeable. Only with controller setting "**Setpoints - independent setpoints**".

Table 71: Additional settings – Heating and Cooling

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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. In addition, it is possible to select between manual **switchover between Heating and Cooling** operation and automatic switchover when selecting "Setpoints dependent on Comfort setpoint" (in the "Temperature controller" menu).

2 Pipe system (2 pipe/1 circuit):
In a common pipe system for the cooling and heating 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 (4 pipe/2 circuit):
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:
Using this setting, it is possible to set whether the controller automatically switches between “Heating” and “Cooling” or whether this process is to be carried out manually via a communication object. With automatic switchover, the controller evaluates the setpoints and knows which mode it is currently in based on the set values and the current actual temperature. If, for example, “Heating” was previously active, the controller switches over as soon as the setpoint for the cooling process is reached. As long as the controller is in the dead zone, the controller remains set to “Heating”, but does not heat as long as the setpoint for the heating process is not exceeded.
If the switchover "via object" is selected, an additional communication object is displayed via which the switchover can be made. With this setting, the controller remains in the selected mode until it receives a signal via the communication object. As long as the controller is in “Heating” mode, for example, only the setpoint for the heating process is considered, even if the controller is actually already in “Cooling” mode from the setpoints. A start of the cooling process is therefore only possible when the controller receives a signal via the communication object that it should switch to the cooling process. If the controller receives a 1 via the communication object, the heating process is switched on, with a 0 the cooling process.

The following table shows the associated communication objects:

Number	Name/Object function	Length	Usage
93	Temperature controller – Switchover: 1= Heating, 0 = Cooling	1 Bit	Switching between “Heating” and “Cooling” Mode:
94	Temperature controller – Status: 1= Heating, 0 = Cooling	1 Bit	Sending the status whether “Heating” or “Cooling” mode.

Table 72: Communication objects – Heating/Cooling switchover

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4.5.6 Additional level

Important: The additional level is only available in "Heating" mode.

The picture shows the available settings:

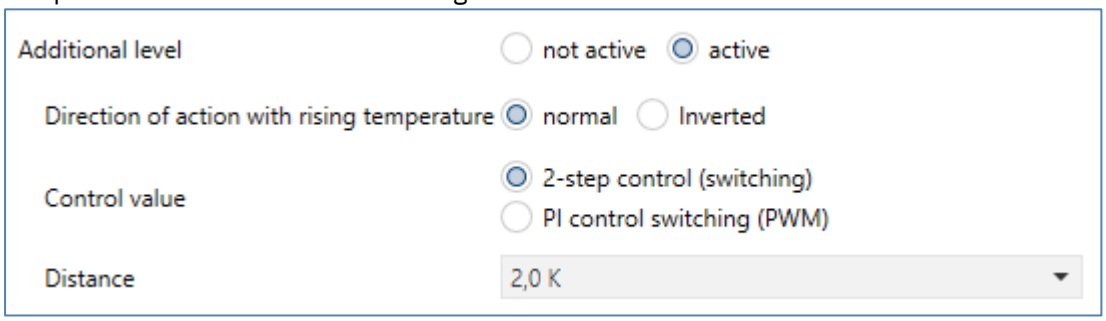

Figure 38: Settings – Additional level

The following table shows the setting options for additional level:

ETS-Text	Dynamic range **[Default value]**	Comment
Additional level	▪ **not active** ▪ active	Activation of the additional level.
Direction of action with rising temperature	▪ **normal** ▪ inverted	Indicates the control behaviour with increasing temperature.
Control value	▪ **2-step control (switching)** ▪ PI control switching (PWM)	Setting the type of controller that is used.
Distance	0,5 – 5,0 K **[2,0 K]**	Defining the setpoint of the additional stage as the difference to the current setpoint.

Table 73: Settings – Additional level

The additional level can be used in slow systems to shorten the heating phase. For example, in the case of underfloor heating (as the basic stage) a radiator or an electric heater could be used as an additional level to shorten the longer heating phase of the slow underfloor heating.
The **direction of action** of the control variable can be set as "normal" or "inverted": For details, see chapter 4.5.4 Direction of controller.
For setting the controller type of the **control value**, the user can choose between 2-step control and PWM control. The communication object of the additional level is therefore always a 1-bit object and only switches the control value ON or OFF.
The setpoint of the additional level can be configured with the parameter "**Distance**". 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 is in Comfort mode for which a basic comfort value of 21°C has been set. The distance of the additional level has been set to 2.0K. This results in the following for the setpoint of the additional level: 21°C - 2.0K = 19°C

The table shows the communication object for the additional level:

Number	Name/Object function	Length	Usage
75	Temperature controller – Additional level: Send control value Heating	1 Bit	Controlling the actuator for the additional level

Table 74: Communication object – Additional level

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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 devices described above must not be used in conjunction with devices which directly or indirectly serve human, health, or life-safety purposes. Furthermore, the devices described must not be used if their use may cause danger to people, animals, or property.
Do not leave the packaging material carelessly lying around. Plastic foils/ bags etc. can become a dangerous toy for children.

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

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