Product documentation

Room controller display module

Art. no. xx 529x D1 ST

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Product image non-binding

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1 Information on the product

1.1 Product catalogue

Product name	Room controller display module 2-gang / Room controller display module 4-gang
Use:	Sensor
Design:	FM (flush-mounted)
Art.-no.:	xx 5292 D1 ST / xx 5294 D1 ST

1.2 Function

General

The room controller module is a TSM (push-button sensor basic module). The TSM combines the functions of a KNX bus coupling unit, two single-room temperature controllers with setpoint specification, a pushbutton sensor (2-gang or 4-gang), and a display unit in just one KNX subscriber.

The combination of these functions makes it possible, for example, to control the light, the blinds, and the room temperature centrally from the entry area of a room.

The room temperature controller and push-button sensor functions are each independent function sections of the device with their own parameter blocks in the ETS.

The 2-gang room controller module has 4 control surfaces. The 4-gang room controller module has 8 control surfaces. The control surfaces can be used to operate the integrated room temperature controllers and the push-button sensor functions. The functions can be configured in the ETS.

Optionally, the number of control surfaces can be expanded to include 8 additional ones by connecting a TSEM (push-button sensor extension module) to the TSM. The configuration and commissioning of the TSEM are clearly structured and easy to perform using the application program of the room controller module.

Display functions

The integrated display shows statuses of room temperature controllers and the settings of the control operating modes for up to two rooms in the Heating and Cooling operating modes. The TSM can show up to 17 pieces of display information, either changing cyclically or directly via a communication object. The menu level is shown on the display, providing that it has been enabled in the parameters. Various temperature values can be displayed in the menu level as an option. It is also possible to change controller settings (setpoint temperatures, presence operation, operating mode, fan control, etc) directly on the device and adjust the brightness of the display. In addition, configurable pushbutton function icons (only in the design ranges LS and CD!) support the operation of the button and rocker functions on the device.

Room temperature controller

The device unites two independent room temperature controllers. Both controllers can be used for separate single-room temperature controllers. Depending on the operating mode, current temperature setpoint and room temperature, a variable for heating or cooling control can be transmitted to the KNX for each control circuit. In addition to the basic level heating or cooling, activating an additional level enables an additional heating or cooling unit to be used. In this connection, you can set the temperature setpoint difference between the basic and the additional level by a parameter in the ETS. For major deviations between the temperature setpoint and the actual temperature, you can activate this additional level to heat up or cool down the room faster. You can assign different control algorithms to the basic and additional levels.
For heating and cooling functions, you can select continuous or switching PI or switching 2-point feedback control algorithms.
The controller distinguishes between different operating modes (comfort, standby, night, frost/heat protection) each with their own temperature setpoints for heating or cooling.

Room temperature measurement

The ETS application program of the device contains three independent blocks for room temperature measurement. Up to three temperatures can be determined in parallel, when the device is installed combined with a TSEM and/or with a connected remote sensor. With a device installation without TSEM and a remote sensor, a room temperature can be determined on the device. Each room temperature measurement can be performed by the internal sensor or, optionally, by a received temperature value. Combined temperature recording (internal sensor + received temperature value) can also be configured.

Push-button sensor functionality

When its buttons are actuated, the device sends telegrams to the KNX, depending on the ETS parameter settings. These can be telegrams for switching, for dimming the brightness and colour temperature or for controlling the shading. Value transmitters and scene extension functions can also be programmed.
The value transmitter functions include, for example, temperature and brightness value transmitters or even the colour value transmitter RGBW.
The device can be used as a room temperature control point, which means as an operation and display element of a room temperature controller.
All buttons or single buttons of the device can be disabled using the disabling function. During active disabling, the assigned buttons perform parameterised behaviour.
With the "dimming and colour temperature" and "short and long button actuation" rocker functions and with "Venetian blind / shutter / awning / skylight" --> "Venetian blind" --> "Step - Up/down or step", special functions can be actuated by operating the full surface of the rocker.
The operation concept of two operating elements can be configured in the ETS either as a rocker function or as a button function. With the rocker function, two control elements work together and execute a basic function. In the button function, each operating element is evaluated separately.

With the rocker function, similar buttons are arranged "horizontally" (left-right operation). Thanks to full-area operation, additional special functions can be triggered if a rocker function is designed.
The 2-gang room controller possesses two status LEDs for each operating element. The 4-gang room controller possesses one status LED for each operating element. The status LEDs can be internally connected to the operating function, according to the function of the rocker or button. Each status LED can then also signal completely independent display information, operating states of room temperature controllers or indicate the results of logic value comparisons, flash or be permanently switched on or off.

LED functions

The room controller module possesses eight status LEDs. The status LEDs are executed in three colours and can – according to choice, in either red, green or blue – be switched on or off permanently or can function as an operation display or as a status display. Furthermore, different statuses of the internal controller can be displayed. As an alternative, with the aid of separate communication objects, they can signal widely varying display information completely independently of the push-button function, e.g. operation states of fault messages or also room temperature controllers, the results of logic value comparisons, flash or be permanently switched on or off. Each colour of a status LED can be controlled either by three separate objects or alternatively by a mutual object (superimposed function), so that traffic light functions can also be implemented, - for example, depending on a limiting value - by means of an LED. When switched-off, the status LEDs can shine in a designed colour, creating an orientation light. The brightness of the status LED can be set to five levels. With brightness reduction, the brightness of the status LED can be reduced at night time using a communication object.
The active programming mode is signalled on the TSM by the status LED 1 and status LED 2 flashing rapidly in blue. The active programming mode continues to be displayed by the "Prog" message in the display of the TSM. When a TSEM is connected, the backlighting and the operation LED flash when the TSM is in programming mode.

Energy saving mode

The device has an energy-saving mode. Is this way, the device saves electrical energy during operation. Energy saving mode is activated either after a preset time without operation or controlled by a KNX telegram. In energy saving mode, the device deactivates the signalling functions. Energy saving mode can be deactivated by operation or by a KNX telegram. Afterwards, the device is fully functional again.

Update capability

The device can be updated. Firmware can be easily updated with the Jung ETS Service App (additional software).

KNX Data Secure

The device is KNX Data Secure capable. KNX Data Secure offers protection against manipulation in building automation and can be configured in the ETS project. Detailed technical knowledge is a prerequisite. A device certificate, which is attached to the device, is required for safe commissioning. During mounting, it is recommended to remove the certificate from the device and to store it securely.

ETS versions

Planning, installation and commissioning of the device are carried out with the aid of the ETS5, version 5.7.7 or higher or of the ETS6, version 6.1.1 or higher.

1.3 Device components

Device components of room controller module

The room controller module is available in the 2-gang and 4-gang variants. The device can be integrated into the switch programs A500, LS990 or CD500. Irrespective of the switch range, the devices make the same button and rocker functions, room temperature controller functions, disabling, scene and alarm signalling functions, as well as status LED functions, available.
There are only differences between the devices of the different switch ranges in the display. The displays of the devices for the LS990 and CD500 switch ranges have the same design and differ from the display of the A500 switch range through a different arrangement of the display information and of the displayable button function icons.

1.3.1 Front view 2-gang

Device components of room controller module 2-gang

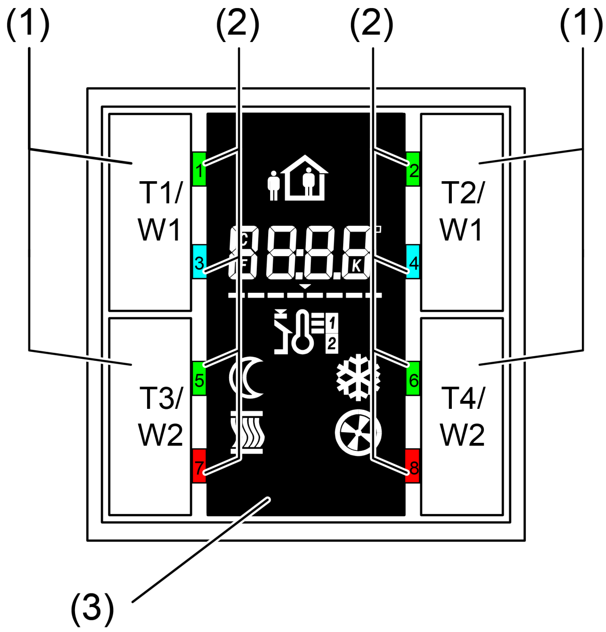

Figure 1: Front view of room controller module 2-gang
(Display: A500 switch range)

(1) 4 control surfaces configurable as rocker 1...2 or as buttons 1…4

(2) 8 status LEDs (red, green, blue), can be freely configured

(3) Display: A500 switch range

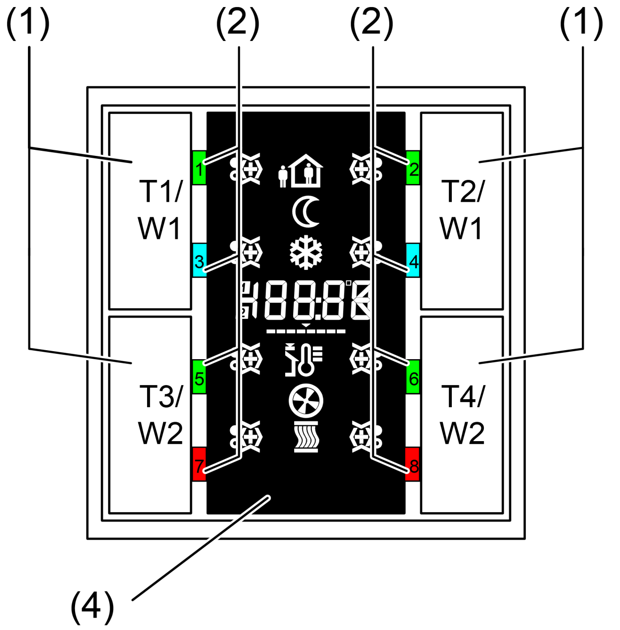

Figure 2: Front view of room controller module 2-gang
(Display: LS990 & CD500 switch range)

(4) Display: LS990 & CD500 switch range

1.3.2 Front view 4-gang

Device components of room controller module 4-gang

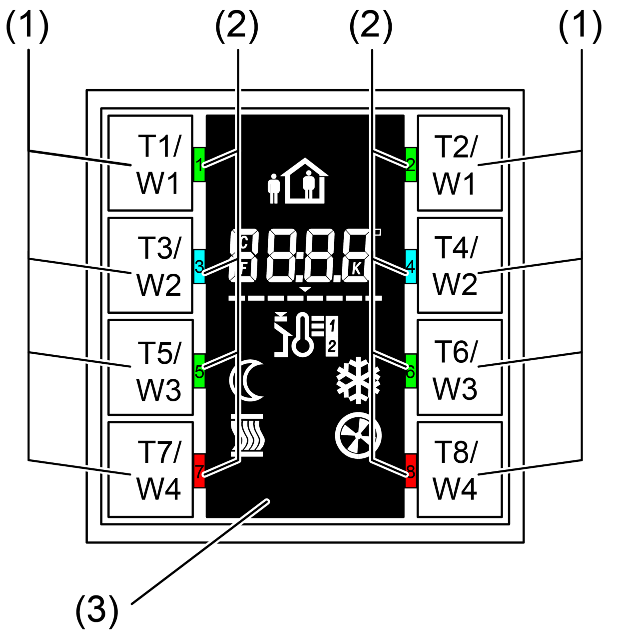

Figure 3: Front view of room controller module 4-gang
(Display: A500 switch range)

(1) 8 control surfaces configurable as rocker 1...4 or as buttons 1…8

(2) 8 status LEDs (red, green, blue), can be freely configured

(3) Display: A500 switch range

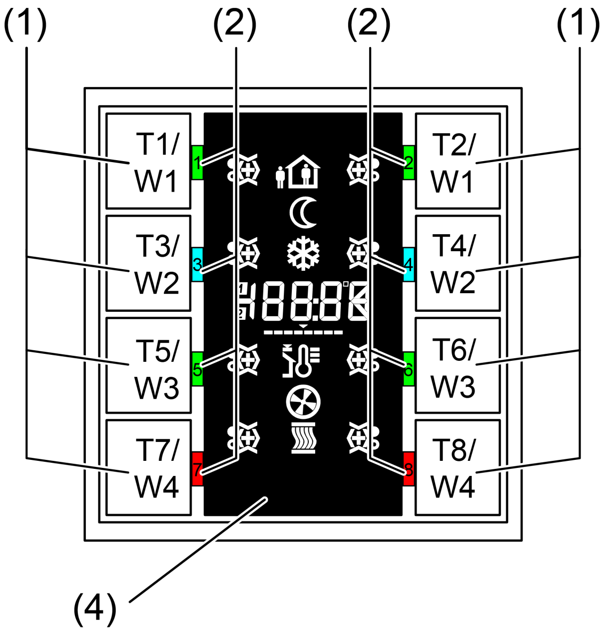

Figure 4: Front view of room controller module 4-gang
(Display: LS990 & CD500 switch range)

(4) Display: LS990 & CD500 switch range

The room controller module can be integrated into the switch programs A500, LS990 or CD500.

1.3.3 Rear side

Device components of room controller module rear side

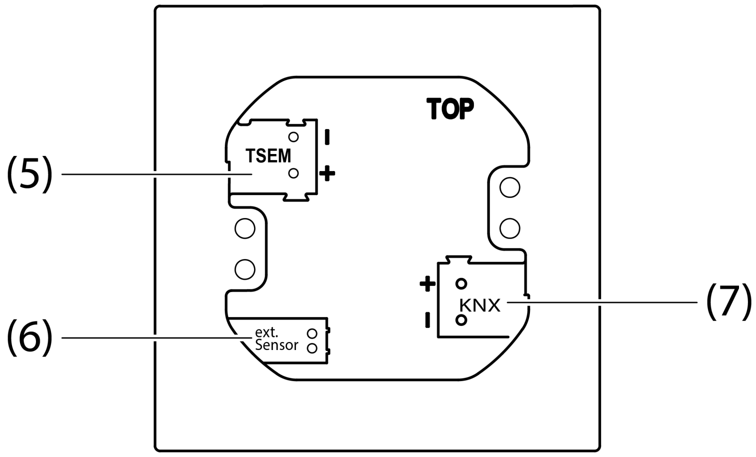

Figure 5: Rear side of room controller module 2-gang/4-gang

(5) Connection of push-button sensor extension module

(6) Connection of remote sensor (external sensor)

(7) Connection of KNX bus cable

1.4 As-delivered state

The delivery state defines the functions of the device when it is connected to the KNX but has not been programmed with application data by the ETS.
This condition persists until the application is programmed into the device.

The text NEU appears in the device display at 100% brightness as soon as the device is supplied with bus voltage.

In the delivery state of this device, the eight status LEDs execute the function of an actuation display. In so doing, the status LEDs light up for the length of the actuation of the corresponding button. The colour of the status LED changes in the following order with each press of a button:

– Red
– Green
– Blue

1.5 Technical data

General

Protection class	III
Test mark	KNX/EIB
Ambient temperature	-5 ...+45 °C
Storage/transport temperature	-25 ... +70 °C

KNX/EIB supply

KNX medium	TP
Commissioning mode	S mode
Rated voltage KNX	DC 21...32 V SELV
Current consumption KNX	
without TSEM	Max. 15 mA
with TSEM	Max. 20 mA

Connection of the extension module

Number	1
Cable length	Max. 30 m
Cable type	J-Y(St)Y 2×2×0.8

Connecting remote sensor

Cable length	Max. 50 m

1.6 Accessories

Cover kit 2-gang	..502 TSA..
Cover kit 4-gang	..504 TSA..
Push-button extension module, 1-gang	..5091TSEM
Push-button extension module, 2-gang	..5092TSEM
Push-button extension module, 3-gang	..5093TSEM
Push-button extension module, 4-gang	..5094TSEM
External temperature sensor	FFNTC

2 Safety instructions

Electrical devices may be mounted and connected only by electrically skilled persons.

Serious injuries, fire or property damage are possible. Please read and follow the manual fully.

Danger of electric shock. Make sure there is always sufficient insulation between the mains voltage and the bus during the installation. A minimum distance of at least 4 mm must be maintained between bus conductors and mains voltage cores.

Use only the enclosed plastic screws for fastening to the supporting frame! Otherwise safe operation cannot be ensured. Electrostatic discharges can cause defects in the device.

3 Mounting and electrical connection

DANGER!

Electrical shock on contact with live parts in the installation environment.

Electric shocks can be fatal.

Before working on the device, disconnect the power supply and cover up live parts in the working environment.

DANGER!

Danger of electrical shock!

When mounting with 230 V socket outlets under a common cover there is a danger of electrical shocks in the event of a fault!

Use only the enclosed plastic screws for fastening to the supporting frame!

CAUTION!

Protect the device against electrostatic discharges. Electrostatic discharges occur when the device is operated in a poor installation situation, dependent on the material characteristics of the floor, wall and device cover.

Electrostatic discharges can cause defects in the device.

Use only the enclosed plastic screws.

Mounting and connecting the device

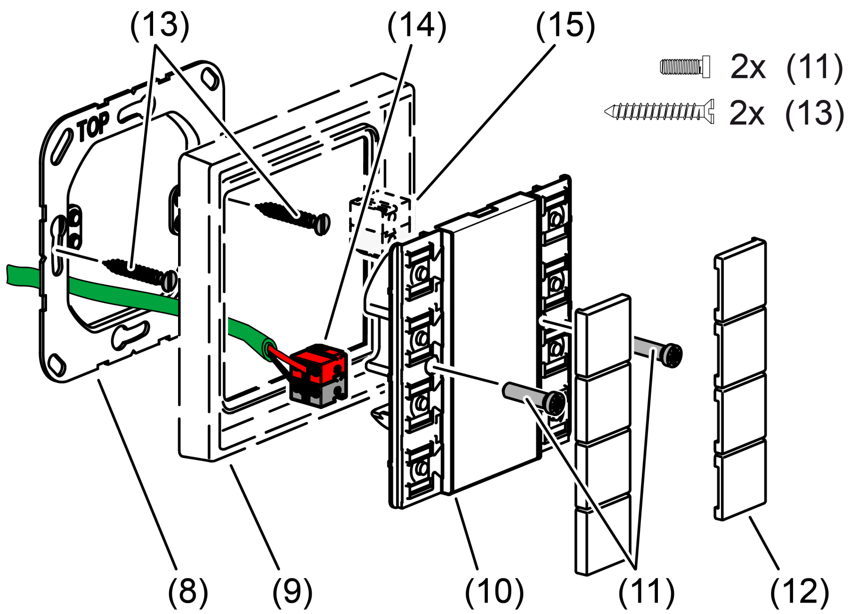

Figure 6: Mounting of the room controller module

(8) Supporting frame
(9) Design frame
(10) Room controller module
(11) Fastening screws
(12) Design operating areas
(13) Box screws
(14) KNX device connection terminal
(15) TSEM device connection terminal

- Mount supporting frame (8) in the right orientation on an appliance box. Note the **TOP** marking. Use the enclosed box screws (13).
- Position the design frame (9) on the supporting frame.
- Connect the room controller module (10) with KNX device connection terminal (14), which is connected to the KNX bus line, on the rear side of the module. Run the connection cable downwards from the room controller module and then into the appliance box from the rear.
- Push the room controller module onto the supporting frame.
- Fix the room controller module to supporting frame using the supplied plastic screws (11). Tighten the plastic screws only lightly.

Connecting and fitting the room controller module with push-button sensor extension module

A push-button sensor extension module (TSEM) can be connected to each room controller module (TSM). The white-yellow wire pair of the bus line, or alternatively a separate cable, can be used as the connection cable. When connecting, make sure the polarity is correct (e.g. on the TSM and TSEM yellow = "+", white = "–").

When the white-yellow wire pair of the bus line is used as the connection cable, the two-wire pair can only connect one TSM and one TSEM to each other along the shortest path. Leading the two-wire pair electrically into the system, e.g. to connect additional push-button sensor modules with each other, is not permitted! Leading further is also not permitted, if this results in total cabling paths of longer than is permitted (max. 30 m).

The white-yellow wire pair of the bus line must not be used to connect room controller modules, if these wires are already used to fulfil other tasks of the KNX installation (e.g. additional power supply for specific bus devices). In this case, a separate connection line is to be used. This is especially to be heeded when retrofitting an existing KNX system.

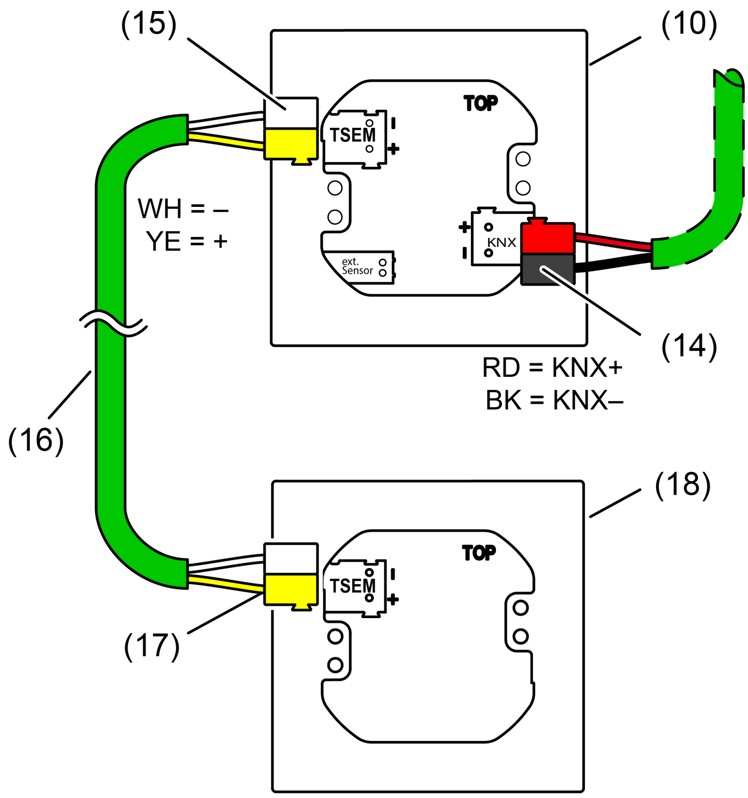

Figure 7: Connection of the push-button sensor extension module (view from rear)

(10) Room controller module

(14) KNX device connection terminal

(15) Device connection terminal for connecting an extension module to TSM, white-yellow

(16) Connection line for extension module

(17) Device connection terminal for extension module on TSEM, white-yellow

(18) Extension module push-button sensor

The TSEM (push-button sensor extension module) can either be mounted in a flush-mounted device combination or also set into a flush-mounted appliance box. Maximum total length of connection line between room controller module and sensor extension module: 30 m.

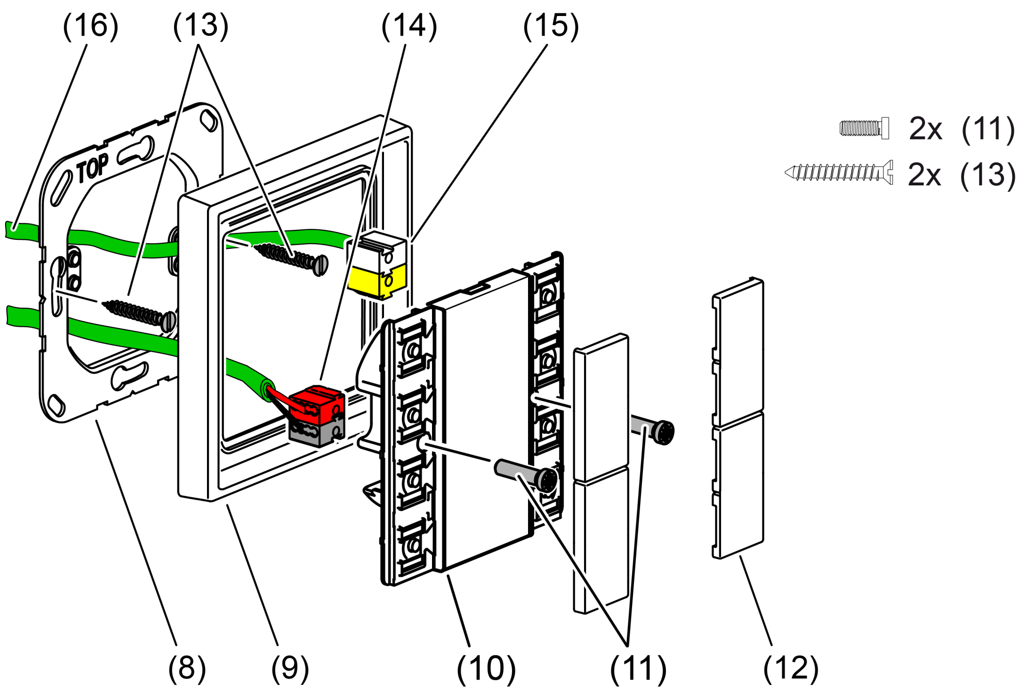

Figure 8: Mounting the compact room controller module with connection of an extension module

(8)	Supporting frame
(9)	Design frame
(10)	Room controller module
(11)	Fastening screws
(12)	Design operating areas
(13)	Box screws
(14)	KNX device connection terminal
(15)	TSEM device connection terminal
(16)	Connection line for TSEM

The room controller module and the extension are mounted in more or less the same manner:

- Mount supporting frame (8) in the right orientation on an appliance box. Note the **TOP** marking. Use the enclosed box screws.
- Lead the bus line and connection line out of the box and through the supporting frame (8) and design frame (9).
- Push design frame (9) onto supporting frame (8).

On room controller module (10):

- Connect the KNX bus line with red-black KNX device connection terminal (14) to the "**KNX**" slot at the back.
- Connect the connection line (16) with white-yellow device connection terminal (15) to the "**TSEM**" slot at the back.

On TSEM (18) (push-button sensor extension module):

- Connect the connection line (16) with white-yellow device connection terminal (15) to the "TSEM" slot at the back.
- Attach the push-button module onto the supporting frame (8).
- Fix push-button sensor module to supporting frame using the supplied plastic screws (11). Tighten the plastic screws only lightly.

4 Commissioning

After connection and mounting, the room controller module can be put into operation. The commissioning is basically confined to programming with the ETS and attaching the decorative operating areas.

The extension module does not receive any physical address of its own. It is activated by the application program loaded in the TSM.

Preconditions in secure operation

– Secure commissioning has been activated in the ETS.
– Device certificate entered/scanned or added to the ETS project. A high resolution camera should be used to scan the QR code.
– Document all passwords and keep them safe.

Programming the physical address

The device does not have a separate programming button or LED. Programming mode is activated by a defined and time-delayed press of the upper left and lower right of the actuation points. The active programming mode on the TSM is indicated by changing the colour of status LED 1 and status LED 2 between red and blue with a frequency of about 4 Hz. An active programming mode is displayed by the "Prog" display. An extension module signals an active programming mode by the labelling panel and the operation LED flashing. To program the physical address, the decorative control surfaces can be snapped onto the device.

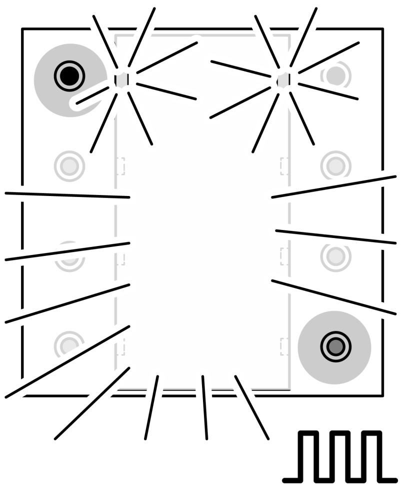

Figure 9: Actuation points for activating programming mode

If the device does not contain an application program - or contains the wrong one - the top two status LEDs 1 and 2 change their colour between red, off, blue and off, at a frequency of around 0.75 Hz as an error display. The word "LEEr" is displayed when empty. If a push-button sensor extension module is connected, the operation LED (colour: blue) and the labelling field illumination of the module flashes slowly.

For commissioning, the TSM must be connected and the bus voltage switched on.

- Activate Programming mode. Press the actuation point at the top left (pushbutton element 1) on the TSM and keep it depressed (see figure 9). Then press the second actuation point at the lower right (pushbutton element 8).

  Programming mode is activated. Both upper status LEDs (status LED 1 and 2) change their colour between red and blue with a frequency of about 4 Hz. If a extension module is connected, its operation LED flashes quickly (approx. 8 Hz). If connected, the active programming mode is still displayed by the flashing labelling field illumination of the TSEM.

Use suitable objects to push the actuation points (e.g. thin screwdriver, tip of a ball-point pen, etc.).

To exclude any inadvertent activation of Programming mode during 'normal' use of the operating element in later operation, the time between the first and the second actuation must be at least 200 ms. Pressing simultaneously (time between first and second actuation < 200 ms) will not result in an activation of Programming mode!

- Program the physical address with the help of the ETS.
- Programming mode ends:
  - Automatically after adoption of the physical address
  - By pressing a button on the TSM

If Programming mode is to be activated or deactivated in a device which is already programmed with a valid application, there is the possibility that telegrams will be transmitted to the bus at the time the button is actuated. The telegram transmitted depends on the button function programmed.

The extension module does not receive any physical address of its own. It is activated by the application program loaded in the TSM. The programming mode cannot be activated or deactivated on the extension module.
When programming mode is active, the extension module can be operated normally. Then the telegrams corresponding to the project design are also transmitted to the bus.

Programming the application program

Program the application into the device with the help of the ETS. Commissioning is possible using ETS5 version 5.7.7 (or higher) or ETS6 version 6.1.1 (or higher).
The ETS detects automatically whether a valid application has already been programmed into the device before. To reduce the programming time, the ETS downloads the whole application only if the device was programmed beforehand with another application or with no application at all. In all other cases, the ETS makes a time-optimised partial download in which only the modified data is loaded into the device.

Installing the decorative control surfaces

The decorative control surfaces are available as a complete set of buttons. Individual buttons or the complete set of buttons can be replaced by buttons with icons.
The design control surfaces are not included in the scope of supply of the device or the extension module. These must be ordered specially according to the required design.

- Place control surfaces on the device in the right orientation and also on the extension module (if used), and snap in with a short push.

4.1 Safe-state mode

The safe-state mode stops the execution of the loaded application program.

If the device does not work properly - for instance as a result of errors in the project design or during commissioning - the execution of the loaded application program can be halted by activating the safe-state mode. The device remains passive in safe-state mode, since the application program is not being executed (state of execution: terminated).

Only the system software of the device is still functional. ETS diagnosis functions and programming of the device are possible.

Activating safe-state mode

- Switch off the bus voltage.
- Press and hold down the top left and bottom right button.
- Switch on the bus voltage.

  Safe-state mode is activated. The top LEDs flash slowly (approx. 1 Hz, blue) and SAFE is shown on the display.

i Only release the buttons when the upper LEDs are flashing.

Deactivating safe-state mode

- Switch off the voltage or carry out ETS programming.

4.2 Master reset

The master reset restores the basic device settings (physical address 15.15.255, firmware remains in place). The device must then be recommissioned with the ETS.

In secure operation: A master reset deactivates device security. The device can then be recommissioned with the device certificate.

If the device - for instance as a result of errors in the project design or during commissioning - does not work properly, the loaded application program can be deleted from the device by performing a master reset. The master reset restores the basic device settings. Afterwards, the device can be put into operation again by programming the physical address and application program.

Performing a master reset

Prerequisite: The safe-state mode is activated.

- Press and hold the button at the top left and the button at the bottom right for more than five seconds until the top status LED flashes quickly (approx. 4 Hz, red).
- Release the buttons.

  The device performs a master reset.

  The device restarts.

Resetting the device to its default settings

Devices can be reset to factory settings with the ETS Service App. This function uses the firmware contained in the device that was active at the time of delivery (delivered state). Restoring the factory settings causes the devices to lose their physical address and configuration.

4.3 Flashing sequence of the status LEDs

State of operation	Status LED	Remarks
Application discharged	With On button pressed (red, green, blue)	
Safe-state mode	Approx. 1 Hz (blue)	Only status LED 1 + 2
Flashing status	Approx. 2 Hz	
Alarm signal	Approx. 2 Hz (red)	All status LEDs
Master reset	Approx. 4 Hz (red)	Only status LED 1 + 2
Programming mode	Approx. 8 Hz (blue)	Only status LED 1 + 2
Full-surface operation	Approx. 8 Hz	Status LED of the operated rocker

5 Operation

The device possesses 8 mechanically separated pushbutton elements. The operating areas are the pushbutton elements combined under an attached design cover. Irrespective of the device variant, the device always possesses eight pushbutton elements. In the 2-gang device variant, 2 pushbutton elements are always combined to form an operating element. The pushbutton elements are visible when no design covers are attached. The operating level and the menu level of the display are operated using pushbutton elements 1 and 2 (see figure 10). For this reason, full-surface operation of rocker 1 is not possible when the menu level is enabled. Depending on the configuration, it is possible to implement a change of the display using each button.

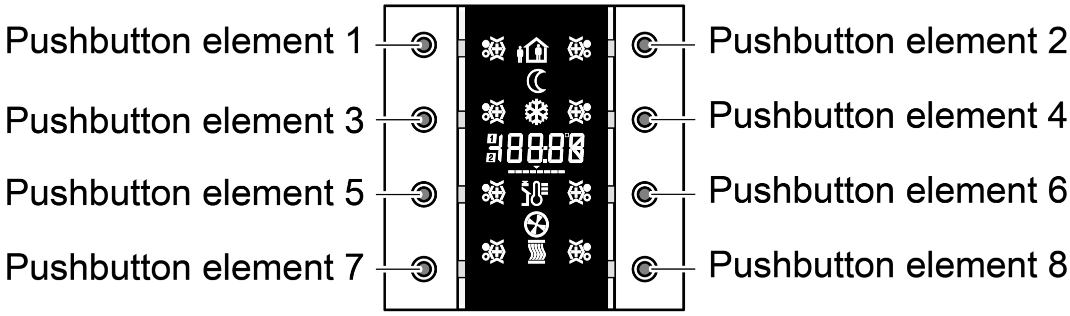

Figure 10: Arrangement of the pushbutton elements

The function of the control surfaces can also be configured in the ETS to any desired push-button sensor function. Alternatively, it is possible to change the display. In addition, simultaneous actuation of pushbutton elements 1 and 2 allows activation of the menu level. Pushbutton elements 1 to 4 operate the activated menu level.

The push-button sensor function is an independent function section of the device with its own parameter blocks in the ETS. Insofar as the control surfaces are to operate one of the integrated room temperature controller, the following functions can be parameterised in the pushbutton configuration: setpoint temperature shift, presence button, operating mode change-over, fan control. For a more detailed description of the operating functions, please see this documentation.

The operating concept can be configured in the ETS either as a rocker function or as a button function. With the rocker function, two neighbouring operating areas are combined into one rocker. In the button function, each operating element is evaluated as single-area operation.
If two control surfaces are used as a rocker function, then, depending on the configuration, it is also possible to trigger special functions through "full-surface operation" of the rocker. For this, both control surfaces should be actuated simultaneously. If the menu level is enabled, full-surface operation of rocker 1 is not possible, because rocker 1 is intended for recall of the menu level.

Optionally, the number of control surfaces can be expanded to include up to 8 additional control surfaces by connecting an extension module to the device. The configuration and commissioning of the extension module are clearly structured and easy to perform using the application program of the room controller module. The operating areas of the extension module can be set in the ETS to any desired pushbutton sensor function, or also to controller operation.

The device possesses eight status LEDs. The status LEDs are executed in three colours and can – according to choice, in either red, green or blue – be switched on or off permanently or can function as an operation display or as a status display. Furthermore, different statuses of the internal controller can be displayed. As an alternative, with the aid of separate communication objects, they can signal widely varying display information completely independently of the push-button function, e.g. operation states of fault messages or also room temperature controllers, the results of logic value comparisons, flash or be permanently switched on or off. Each colour of a status LED can be controlled either by three separate objects or alternatively by a mutual object (superimposed function), so that traffic light functions can also be implemented, - for example, depending on a limiting value - by means of an LED.

Moreover, the device has functions which are not linked directly with the rockers or buttons. These include the thermostat extension function, pushbutton function disable, the internal scenes and the indication of alarm signals.

5.1 Operating level

Up to 17 pieces of display information (actual temperature, setpoint temperature, outdoor temperature, any temperature) can be optionally displayed on the LC display in the basic display of the device with the room temperature controller icons. The information is shown separately on the display. It is possible to change over between the information automatically after set times or in a controlled manner by pressing a button on the device. These properties and the actually visible display information are configured in the ETS before the device is commissioned.

The temperatures can be displayed in **°C** or alternately in **°F**. The display format can be configured in common for all temperature values in the ETS.

5.2 Menu level

The menu level makes it possible to make various basic settings on the unit locally without using the ETS. In order to avoid the unintentional disruption of essential functions, access to individual settings or to the entire menu level can be prevented via the parameterisation in the ETS.

Recalling the menu level

The menu level is recalled by pressing buttons 1 and 2 on the device simultaneously (see figure 11).

Exiting the menu level

The device leaves the menu level again when buttons 1 and 2 are pressed again simultaneously. In this case, depending on the setting of the ETS parameter "Save changes after manual exit", all the settings made are saved or rejected. The parameters "Exit automatically", "Switch-on time" and "Save changes" define whether the device terminates the menu level automatically if no entries are made, and whether in this case all of the changed settings are saved or discarded.

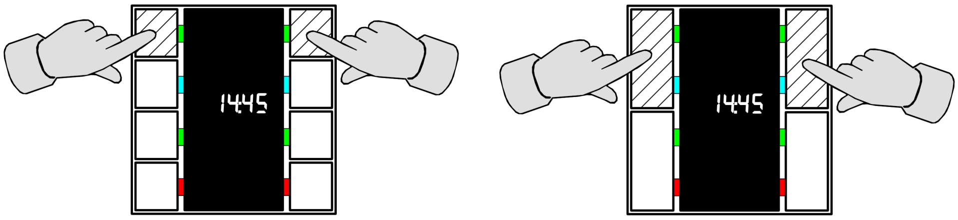

Figure 11: Button combination to recall the menu level
(Left: 4-gang device variant, right: 2-gang device variant)

Operation in the menu level

The settings in the menu level are organised in a ring-shaped menu. This is shown in the display. Selection and settings are performed using buttons 1...4 of the device.

The following graphic depicts the functions within the menu level, using the example of display brightness adjustment. The graphics show the display for the LS990 and CD500 switch ranges. The four buttons have the following functions:

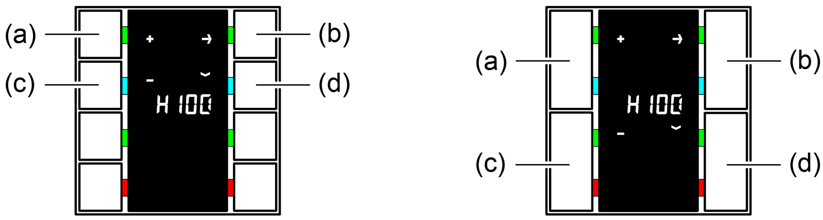

Figure 12: Button functions in the menu level
(Left: 4-gang device variant, right: 2-gang device variant)

(a)	Positive value adjustment
(b)	Jump to the menu item / jump back to the menu level
(c)	Negative value adjustment
(d)	Jump to the next menu entry

Continuous adjustment of the value settings is possible if buttons 1 or 2 are held down.

Project design in the ETS offers various options for influencing the entries that are visible and changeable in the menu:
1. If entries are configured via parameterisation as "Inactive", they do not appear in the menu. This setting is performed in the ETS separately for various menu items in the parameter node "Display -> Display - General -> Submenu …". Some entries are always visible and can thus not be configured as invisible in the ETS.
2. The setpoint temperatures of the controller can either be changeable, or can alternatively only show the current value and thus not be changeable. This setting is performed in the ETS in the parameter node "Display -> Display - General -> Submenu ...".

The menu entry that is shown as the first entry when the menu level is called up can be selected in the ETS using the parameter "First menu item in menu level". The sequence of the subsequent entries is then fixed as shown below.

The following menu functions can be called up in the menu level, if not explicitly disabled in the ETS. The icons shown in the display indicated which function or which temperature value is displayed or set.

Indicating the time:

Figure 13: Indicating the time

Only indication of the current time. No adjustment possibility.
The menu entry "Time" is visible as an option.

Indicating the actual temperature:

Figure 14: Indication of actual temperature

Only display of the actual temperature received via object. No adjustment possibility.
The menu entry "Actual temperature" is visible as an option.

Indication of setpoint temperature:

Figure 15: Indication of setpoint temperature

Only indication of the setpoint temperature received via object. No adjustment possibility.
The menu item "Setpoint temperature" is optionally visible.

Indicating the outdoor temperature:

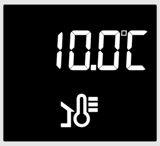

Figure 16: Indicating the outdoor temperature

Only display of the outdoor temperature received via object. No adjustment possibility.
The menu entry "Outdoor temperature" is visible as an option.

Indicating up to any three temperatures:

Figure 17: Indication of any temperatures 1 to 3

Only display of any temperature 1 to 3 received via the object. No setting option.
The menu entry "Any temperature *n*" is visible as an option.

Display for recalling the Controller 1 and 2 submenu:

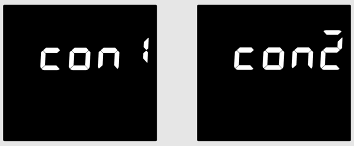

Figure 18: Display for recalling the Controller 1 and 2 submenu

Indication of the Controller 1 and Controller 2 submenu. Actuating button 2 jumps to this submenu.
The menu entry "Controller *n* submenu" is visible as an option.

Display for recalling the display settings:

Figure 19: Display for recalling the display settings

Indication of the submenu of the display settings. Actuating button 2 jumps to this submenu.
The menu entry "Display settings" is visible as an option.

Setting the basic temperature / comfort temperature (Controller n submenu):

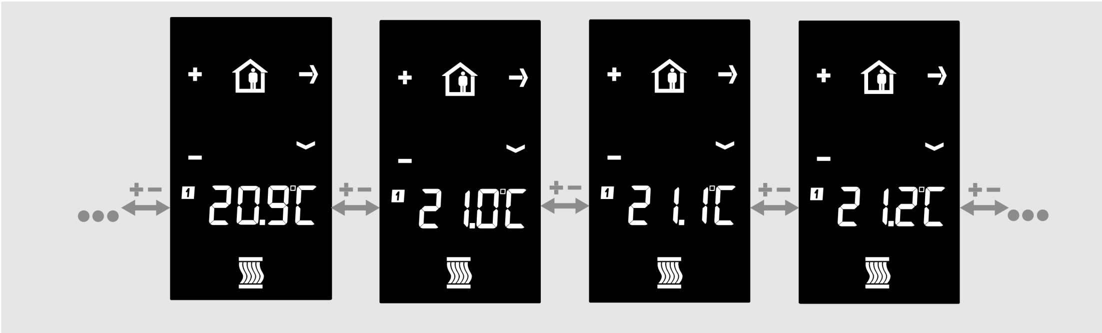

Figure 20: Setting the basic temperature / comfort temperature

The **+** and **-** buttons can be used to adjust the basic temperature /comfort temperature in step width of +/- 0.1 K. The icons and are illuminated in the display. The basic temperature / comfort temperature is displayed flashing as an absolute value in **°C** or **°F** (parameter-dependent).
The basic temperature designates the comfort setpoint temperatures for heating and cooling, depending on the configured operating mode. With "Heating only" it sets the setpoint temperature for comfort heating directly. With "Cooling only", on the other hand, it sets the setpoint temperature for comfort cooling. With "Heating and cooling" the basic setpoint sets the setpoint temperature for heating directly or indirectly depending on the deadband position. The setpoint temperature for cooling is then derived from this, taking the deadband into account.
The menu entry "Basic temperature / comfort temperature" is visible as an option as a component of the Controller *n* submenu. The editing function can be disabled separately. This menu is not accessible in controller extensions.

Setting the setpoint temperature "Lowering for standby mode, heating" ("Controller n" submenu):

Figure 21: Setting the setpoint temperature "Lowering for standby mode, heating"

The **+** and **-** buttons can be used to adjust the temperature decrease for standby mode for heating with a step width of +/- 0.1 K. The icons and are illuminated in the display. The temperature decrease is displayed flashing as a relative value in **K**.
The menu entry "Setpoint temperature heating standby" is optionally visible as a component of the "Controller *n*" submenu. The editing function can be disabled separately. This menu is not accessible in controller extensions.

Setting the setpoint temperature "Raising for standby, cooling" ("Controller n" submenu):

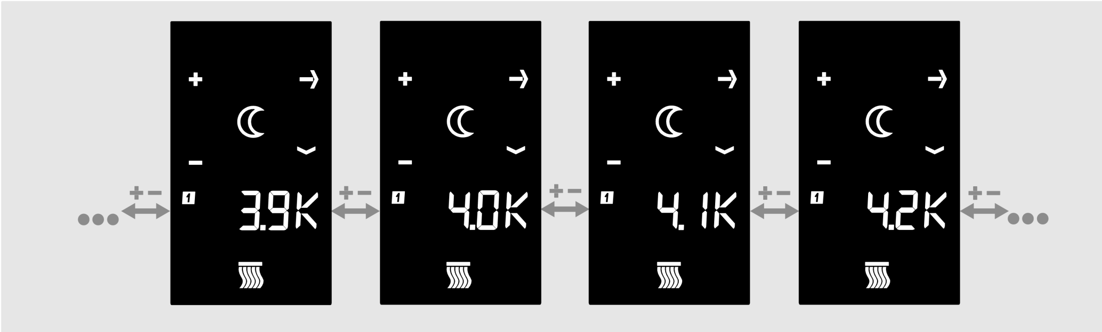

Figure 22: Setting the setpoint temperature increase for standby cooling

The **+** and **-** buttons can be used to adjust the temperature increase for standby for cooling with a step width of +/- 0.1 K. The icons and are illuminated in the display. The temperature increase is displayed flashing as a relative value in **K**.
The menu entry "Setpoint temperature raising standby" is optionally visible as a component of the "Controller *n*" submenu. The editing function can be disabled separately. This menu is not accessible in controller extensions.

Setting the setpoint temperature "Lowering for night mode, heating" ("Controller n" submenu):

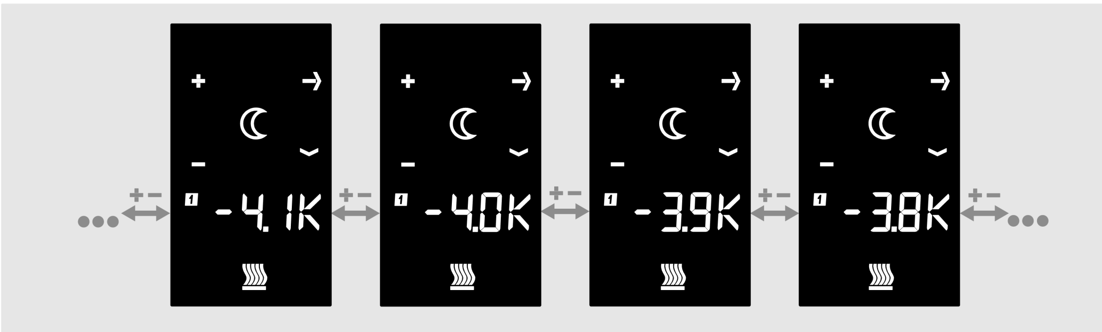

Figure 23: Setting the setpoint temperature reduction for night mode heating

The **+** and **-** buttons can be used to adjust the temperature reduction for night mode for heating with a step width of +/- 0.1 K. The icons and are illuminated in the display. The temperature decrease is displayed flashing as a relative value in **K**.
The menu entry "Setpoint temperature lowering night" is optionally visible as a component of the "Controller *n*" submenu. The editing function can be disabled separately. This menu is not accessible in controller extensions.

Setting the setpoint temperature "Raising for night mode, cooling" ("Controller n" submenu):

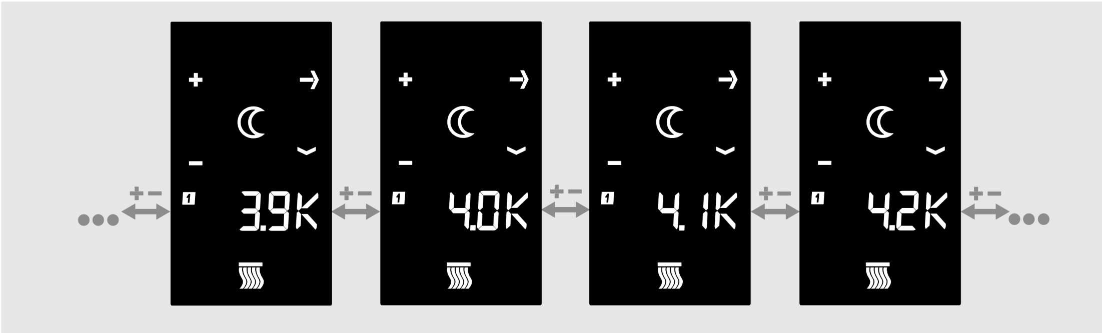

Figure 24: Setting the setpoint temperature increase for night mode cooling

The **+** and **-** buttons can be used to adjust the temperature increase for night mode for cooling with a step width of +/- 0.1 K. The icons ☾ and are illuminated in the display. The temperature increase is displayed flashing as a relative value in **K**. The menu entry "Setpoint temperature raising night" is optionally visible as a component of the "Controller *n*" submenu. The editing function can be disabled separately. This menu is not accessible in controller extensions.

<u>Setting presence mode ("Controller n" submenu):</u>

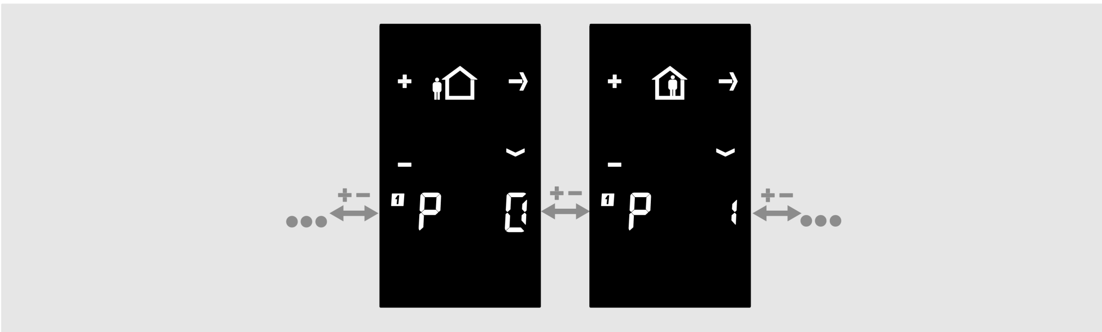

Figure 25: Setting presence mode

A "**P**" is shown in the display to indicate that the presence mode can be edited. "**P 0**" displays that no presence is active. "**P 1**" stands for active presence. The icons additionally shown in the display identify the active operating mode of the internal room temperature controller. Depending on this, presence mode can be adjusted as follows using the **+** and **-** buttons.

"Comfort" operating mode active:
No setting of presence mode is possible. The icon lights up statically.

"Standby" operating mode active:
The **+** or **-** buttons can be used to change over the operating mode between Comfort and Standby . In each case, the icons activated by the Presence operating mode flash.

"Night" operating mode active:
The **+** or **-** buttons can be used to change over the operating mode between Night ☾ and Comfort extension ☾. In each case, the icons activated by the Presence operating mode flash.

"Frost/heat protection" operating mode active:
The **+** or **-** buttons can be used to change over the operating mode between Frost/heat protection ❄ and Comfort extension ⌂❄. In each case, the icons activated by the Presence operating mode flash.

The comfort extension cannot be activated using the presence function in the menu level if the frost/heat protection has been activated via the window status!

In the menu level, presence mode and operating mode (see "Setting the operating mode" below) may never be changed at the same time before a "save" command. Otherwise the presence status is always reset, and thus the manual setting may not be applied. If the controller operating mode and the presence mode have to be changed, first the operating mode has to be changed and the setting has to be saved. Only after that is it possible to change the presence mode and save this setting by calling up the menu level again.

The menu entry "Presence" is visible as an option. This menu is not accessible in controller extensions.

Setting the setpoint temperature shift ("Controller n" submenu):

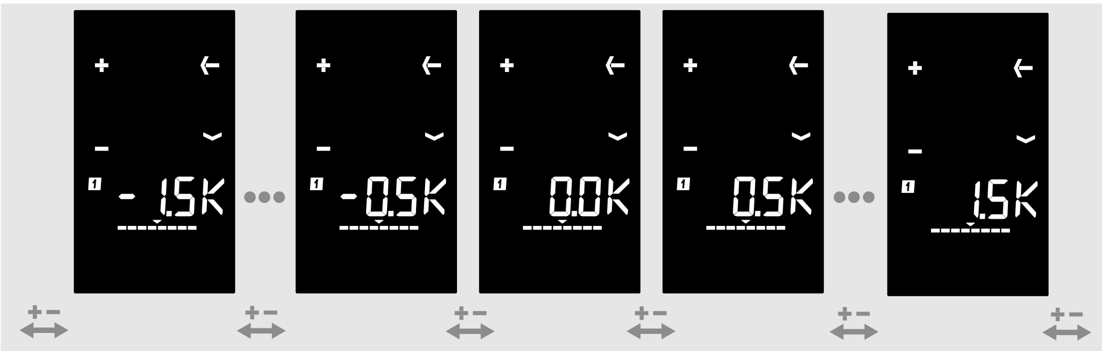

Figure 26: Setting the setpoint temperature shift

The menu entry for the setpoint temperature shift is indicated in the display by the bar scale "- - - - -▼- - - -". The **+** and **-** buttons can be used to adjust the basic setpoint temperature shift by up to 4 levels. Here the shift is shown in the display as a relative numeric value in kelvin (K).
The step width of the shift depends on the ETS parameter "Step width of the 4-stage setpoint temperature shift " in the parameter branch "Room temperature controller ..-> RTC .. General -> Setpoints".

A setpoint temperature shift cannot be saved when the menu level is exited if the frost/heat protection is activated in the controller! In this case the settings of the setpoint temperature shift in the menu level are lost.

The menu entry "Setpoint temperature shift" is visible as an option. This menu is not accessible in controller extensions.

Setting the operating mode ("Controller n" submenu):

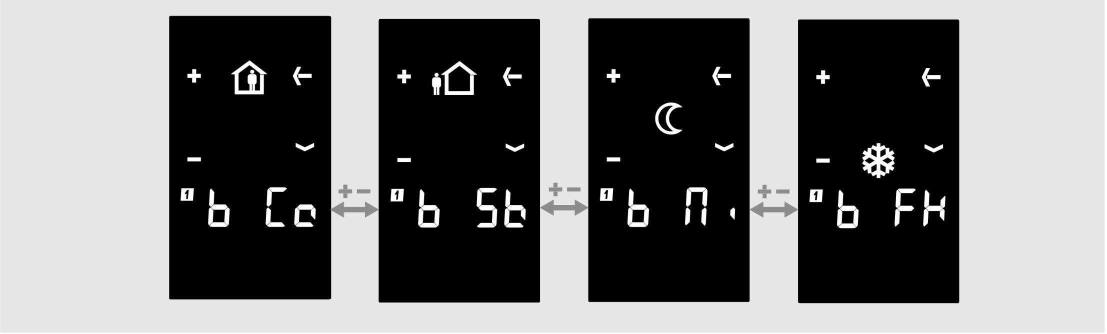

Figure 27: Setting the operating mode

The **+** and **-** buttons can be used to adjust the controller operating mode.

The set operating mode is indicated in the display by the following codes:

– b Co = Operating mode Comfort
– b Sb = Operating mode Standby
– b Ni = Operating mode Night
– b FH = Operating mode Frost/heat protection

The additional blinking icons in the display identify the active operating mode. The modes that can be set are "Comfort" , "Standby" , "Night" and "Frost/heat protection" .
It should be noted that a set operating mode with a low priority cannot be activated immediately when the menu level is exited if an operating mode with a higher priority (e.g. frost protection via window status) has been specified by the controller. The operating mode set in the menu level is only accepted by the controller when the operating mode with a higher priority has been terminated and in the meantime no other operating mode specification with a higher priority has been performed (e.g. via operation of a pushbutton sensor or via communication objects).
The menu entry "Operating mode" is visible as an option. This menu is not accessible in controller extensions.

Fan controller ("Controller n" submenu):

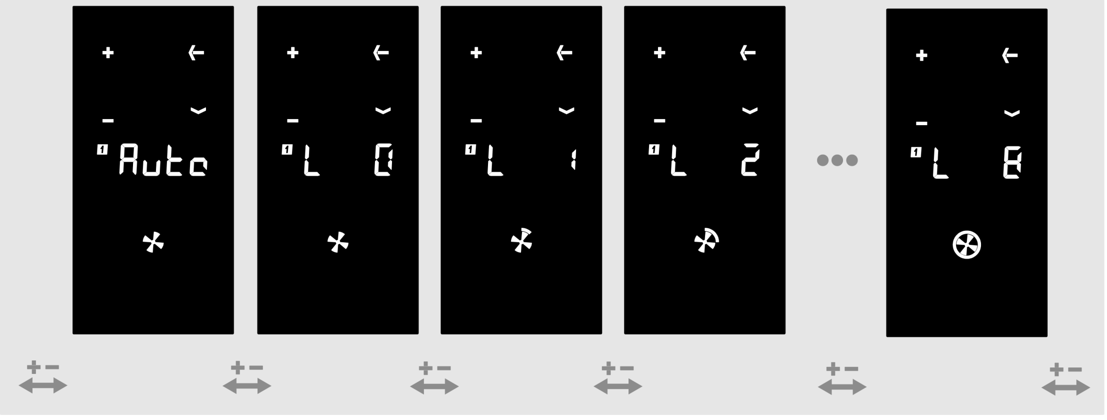

Figure 28: Fan controller

The **+** and **-** buttons can be used to influence the fan operating mode (automatic / manual mode). In manual mode, it is possible to change over the fan level independently of the controller command values.

The set fan level is indicated in the display by the following codes:

- Auto = Automatic mode
- L 0 = Fan level 0 (manual operation)
- L 1 = Fan level 1 (manual operation)
- L 2 = Fan level 2 (manual operation)
- L 3 = Fan level 3 (manual operation)
- L 4 = Fan level 4 (manual operation)
- L 5 = Fan level 5 (manual operation)
- L 6 = Fan level 6 (manual operation)
- L 7 = Fan level 7 (manual operation)
- L 8 = Fan level 8 (manual operation)

The additionally flashing icon in the display indicates the current fan level by means of the illuminated arc segments (, , , , etc.). If no arc segment is illuminated, the fan is switched off. The number of illuminated arc segments depends on the number of fan levels configured.

In fan control in the menu level the fan level and automatic mode can be set directly without taking into account the specific settings of the fan controller (Parameter "Fan level on change-over to manual", the switch-on level or fan run-on times).

The menu item "Fan levels" is visible as an option, but only if the fan control is also enabled in the controller for the ETS. This menu is not accessible in controller extensions.

Recall the display pixel text ("Display settings" submenu):

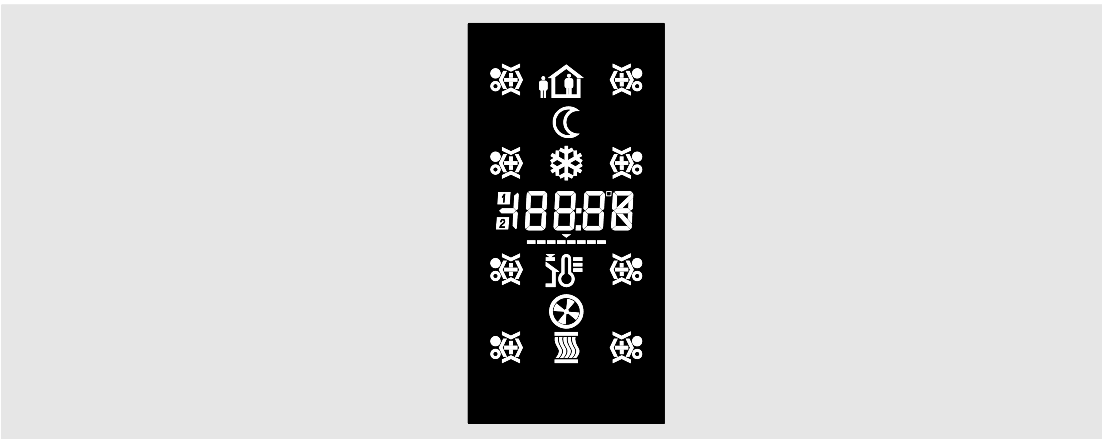

Figure 29: Pixel text in the design ranges LS and CD

All the segments are switched on in the display. The view to be expected in the design ranges LS and CD during the pixel test is shown (see figure 29).
The view to be expected in the design range A500 during the pixel test is shown (see figure 30).

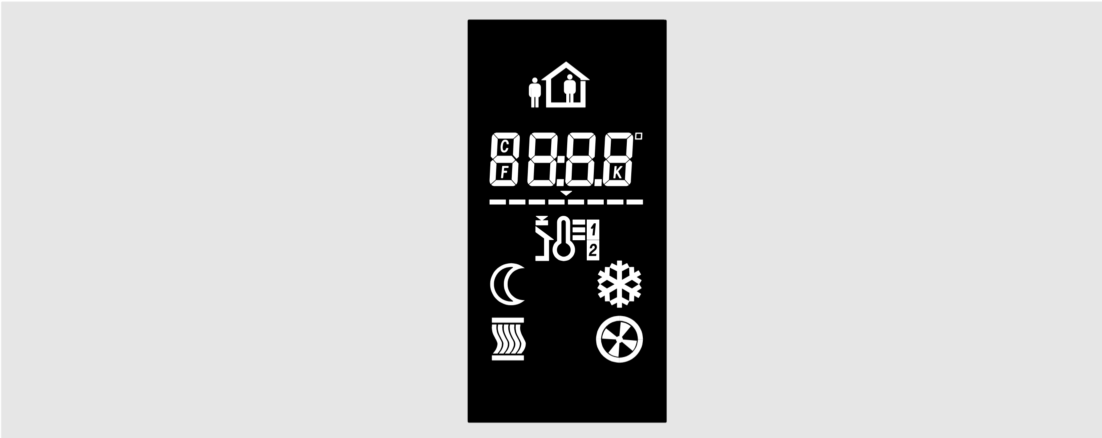

Figure 30: Pixel text in the design range A500

Setting the display brightness ("Display settings" submenu):

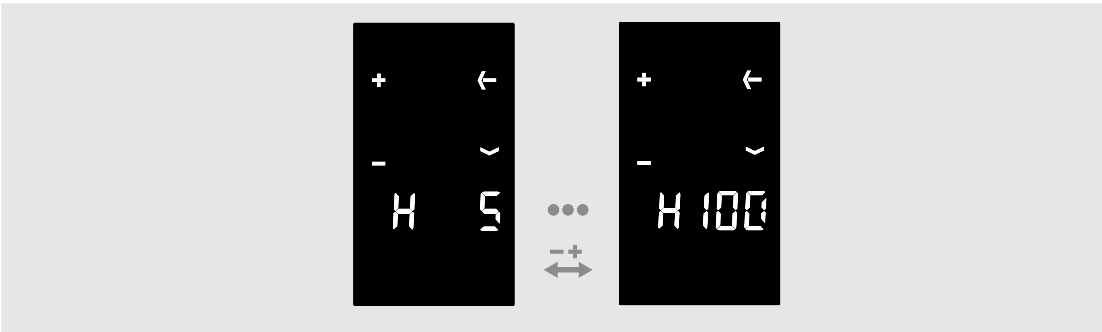

Figure 31: Setting the display brightness

"**H**" and the brightness value of the backlighting are displayed in the backlighting. The **+** and **-** buttons can be used to adjust the brightness of the display in the range from 5 to 100%. For additional notes about control of the backlighting, via the menu level, please see the chapter "Display control".
The menu item "Display brightness" is visible as an option.

Exiting the menu level with saving:

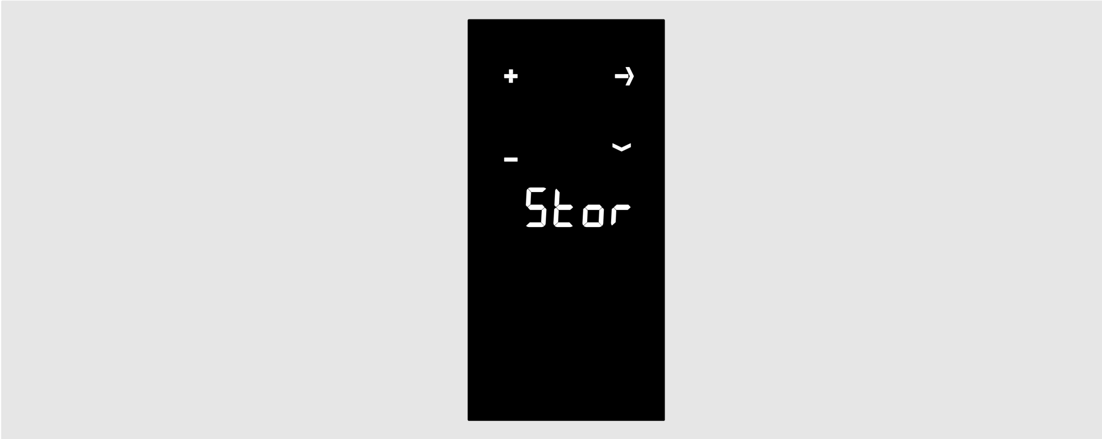

Figure 32: Exiting the menu level with saving

"Stor" is displayed. The button 2 can be used to exit the menu level with a "save" command (see "Exiting the menu level").
This option is always visible.

Exiting the menu level without saving:

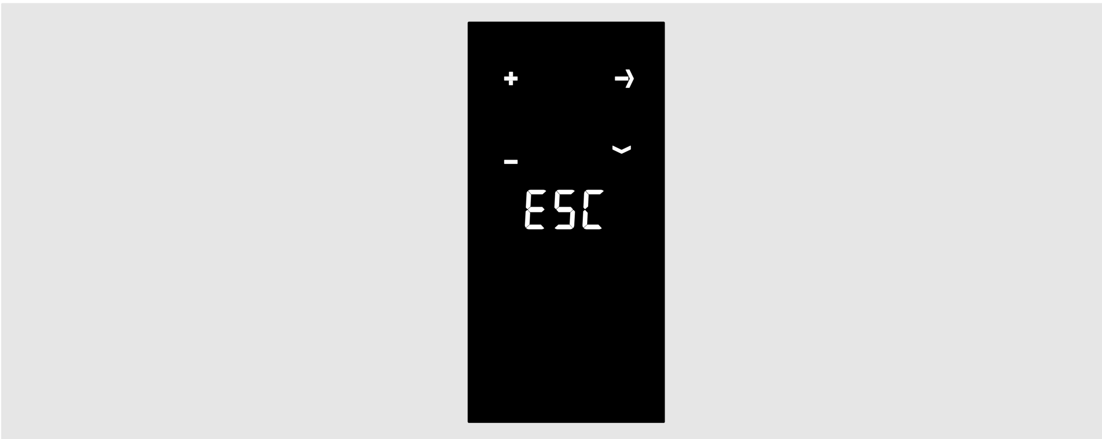

Figure 33: Exiting the menu without saving

"ESC" is shown on the display. Button 2 can be used to exit the menu level without saving the settings (see "Exiting the menu level").
This option is always visible.

All menu entries are displayed or not depending on the configuration of the ETS. If, for example, the controller is parameterised only for heating, no setpoints for cooling can be displayed or set in the menu. When the device functions as a controller extension, controller settings (setpoint temperature shift, setpoint shifting, operating mode, fan control) are fundamentally not accessible in the menu level.
If an entry has been parameterised as the first menu item in the ETS that is not accessible at all due to the other settings, the first possible entry is displayed according to the defined menu sequence (see above).

When a menu entry is shown on the display, the setting currently valid in the controller is identified using the icons or the display value, if the setting has not already been changed previously in the menu level. If the setting has already been changed and not yet accepted validly (see "Exiting the menu level"), the last manual setting will be shown on the display, and not the real state of the controller.

Exiting the menu level

Settings that have been made in the menu level are only accepted validly in the device when the menu level is exited with a "Save" command. It is possible to discard settings by exiting the menu level without a "Save" process.

When exiting the menu level, a distinction is made among the following cases:

– Exiting by means of button combination: The menu level is exited by pressing buttons 1 and 2 on the device simultaneously. The parameter "Save changes after manual exiting" defines whether the settings are saved or not when the menu level is exited using the button combination (button 1 and button 2 simultaneously).
– Automatic exiting: Automatic exiting of the menu level can optionally be configured in the ETS using the parameter of the same name in the parameter branch "General -> Basic settings -> Menu level". In this case the device leaves the menu level when no additional operation takes place after the last push-button operation within the "Time until automatic menu level exit" configured in the ETS. With automatic exiting, it is also possible to define with the parameter "Save changes after automatic exiting" whether the settings are saved or not.
– Exiting with "Stor": In the menu level the menu item "Stor" can be selected with the button 4. The button 2 can then be used to exit the menu level. All settings are always saved in this case!
– Exiting with "ESC": In the menu level the menu item "ESC" can be selected with the button 4. The button 2 can then be used to exit the menu level. In this case the settings are not saved and are discarded!

6 Application programs

ETS search paths:	Heating, air conditioning, ventilation / controller /Room controller display module 2-gang
	Heating, air conditioning, ventilation / controller /Room controller display module 4-gang
Configuration:	S-mode standard

Application program available for Room controller display module 2-gang

Name	Room controller module D16221
Version	2.1 for ETS5 version 5.7.7 or higher, or ETS6 version 6.1.1 or higher.
from mask version	07B0
Summarized description	Multifunctional room temperature controller / push-button sensor application: 4 operating elements on the room controller module for the push-button sensor function and for operation of the integrated room temperature controller. Can be expanded to include 8 additional control surfaces using an extension module.

Name	Room controller module D16222
Version	2.2 for ETS5 version 5.7.7 or higher, or ETS6 version 6.1.1 or higher.
from mask version	07B0
Summarized description	Compared to the version 2.1, additions were made to the application program for the value ranges of the "Value transmitter" and additions were made to "room temperature input" "setpoint temperature limitation for cooling" and "setpoint temperature increase for heating".

Application program available for Room controller display module 4-gang

Name	Room controller module D16421
Version	2.1 for ETS5 version 5.7.7 or higher, or ETS6 version 6.1.1 or higher.
from mask version	07B0
Summarized description	Multifunctional room temperature controller / push-button sensor application: 8 operating elements on the room controller module for the push-button sensor function and for operation of the integrated room temperature controller. Can be expanded to include 8 additional control surfaces using an extension module.

Name	Room controller module D16422
Version	2.2 for ETS5 version 5.7.7 or higher, or ETS6 version 6.1.1 or higher.
from mask version	07B0
Summarized de-scription	Compared to the version 2.1, additions were made to the ap-plication program for the value ranges of the "Value transmit-ter" and additions were made to "room temperature input" "set-point temperature limitation for cooling" and "setpoint temperat-ure increase for heating".

7 Device generations and ETS application programs

Compatibility

The following table shows the compatibility of the devices with the available versions of the firmware and the ETS application programs.

Firmware version	Version of the ETS application program	Devices with device generation V01 or higher
1.0.0	2.1	compatible First release for market launch
1.1.0	2.2	compatible Second release after market launch

Firmware update

The firmware of the device can be updated by programming the device with a more recent application than version 2.1. The update can eliminate errors contained in the firmware. As soon as new firmware is available for the devices, it is displayed in the service app.

There are different device generations and application programs available. It is possible to distinguish between the application programs and device generations by means of the version designation.

Application programs with the version 2.1 or higher can be programmed in devices with device generation V01 or higher.

The parameter settings and group address connections are adopted using the ETS function "Update application programme version".

The designation of the device generation is attached on the device.

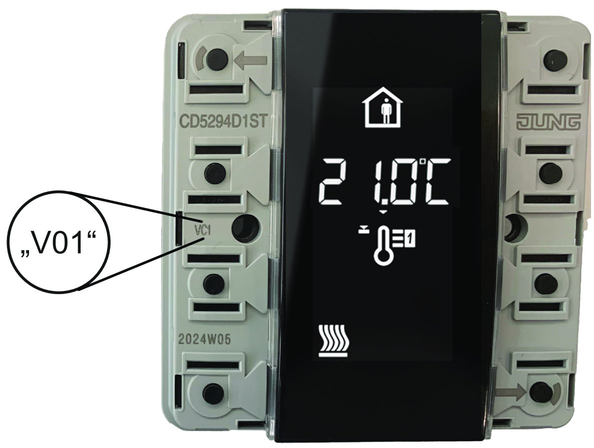

Figure 34: Designation of the device generation on the device

8 Scope of functions

General functions

- KNX Data Secure capable
- Firmware updates are possible
- The number of push-button operations can be extended using a push-button sensor extension module.
- Internal clock to indicate the time on the device display. The time information is made available to the device using a communication object (e.g. by a KNX/EIB timer switch). Automatic time request possible after a device restart.
- LC display with backlighting The backlighting can be switched permanently on or off. It can be switched on with a button-press, be switched on during night operation or be switched by a communication object. The brightness of the background illumination can be set within the menu level or optionally via a communication object.
- Integrated scene control. Internal storage of up to eight scenes with eight output channels, recall of internal scenes by means of a presettable scene number, selection of object types for the output channels; for each scene, the storage of the individual output values and the transmission of the output values can be permitted or inhibited; the individual channels can be delayed during scene recall; as scene extension, 64 scenes can be recalled and stored.
- Alarm signal. If the alarm message is activated, all the status LEDs flash red.
- Push button lock. The designed scope of functions ranges from the disabling of all the buttons, through the disabling of individual buttons up to the assignment of a special disabling function behaviour of the buttons.

Display functions

- Indication of a cycle of up to 17 display pages or activated directly via an object. Optionally, the indication can also be switched by pressing a button on the device.
- Indication of a temperature optionally combined with the icons of one of the two controller cycles. The following temperatures can be displayed: Actual temperature, setpoint temperature, outdoor temperature, any temperature 1-3.
- In the menu level, actual controller values, setpoint controller values, the controller status, the controller operating mode or the fan levels can be displayed for both controller circuits.
- Indication of button function icons for visualisation of the button functions (only in the design ranges LS and CD!).
- Brightness reduction for the display possible, e.g. during the night.
- Indication of menu level.
- Programming mode is signalled by the text "Prog" on the display. If a valid application is already loaded into the device and the device is set back into Programming mode, Programming mode is signalled alternately by the text "Prog" and the displayed firmware version (e.g. "A1.00") in the display.
- The display shows the text "LOAd" during an active programming operation.

- In the delivery state, the text "NEU" is shown in the display.
- If the device does not contain an application program - or contains the wrong one - the text "LEEr" appears.

Functions of the integrated room temperature controller

- Parallel operation of both controllers is possible.
- Function buttons for operation of the room temperature controller.
- Various operating modes can be activated: Comfort, Standby, Night and Frost/heat protection
- Each operating mode can be assigned its own temperature setpoints (for heating and/or cooling).
- Configuring the temperature setpoints as relative (derived from basic setpoint) or absolute (independent setpoint temperatures for each operating mode).
- Comfort extension possible using presence button in Night or Frost/heat protection mode. Configurable duration of the comfort extension.
- Operating mode change-over via a 1-byte object according to KNX or using up to 4 individual 1-bit objects.
- Frost/heat protection switchover via window status or by automatic frost protection.
- Indication of room temperature controller information via the status LED and the display.
- Operating modes "Heating", "Cooling", "Heating and cooling" each with or without additional level.
- Various control types can be configured for each heating or cooling level: PI control (permanent or switching PWM) or 2-point control (switching).
- Control parameter for PI controller (if desired: proportional range, reset time) and 2-point controller (hysteresis) adjustable.
- The temperature setpoints for the additional level are derived via a configurable level offset from the values of the basic level.
- Automatic or object oriented switchover between "heating" and "cooling".
- A temporary or permanent setpoint shift for a relative setpoint presetting through operation of the function buttons on the device or via communication objects is possible. Indication of the setpoint temperature shift possible via status LED.
- Activation of an external fan using an automatic or manual fan control possible. Status display of the fan controller possible by individual status LEDs. Furthermore, a temporary fan level indication can be implemented via all 8 status LEDs of the TSM.
- Status feedback telegrams can be configured.
- Deactivating the feedback control or the additional level possible using separate 1-bit objects.
- Internal and external temperature sensor for room temperature measurement possible.

- Configurable internal to external determination of measured value and external sensor for room temperature measurement. Settable polling time of the external temperature sensor.
- The room temperature measurement (actual value) can be adjusted separately for the internal and external sensor using parameters.
- The actual and setpoint temperatures can be output on the bus if a configurable deviation is detected (also periodically).
- Separate or shared command value output in heating and cooling mode. This produces one or two command value objects for each level.
- Normal or inverted command value output configurable.
- Automatic transmission and cycle time for actuating output configurable.
- Command value limit possible.
- Clipping mode (response of the controller to command values = 100 %) can be set.
- Floor temperature limit possible in heating mode. Thus temperature-controlled switch-off of a floor heater as protective function.
- Setpoint temperature limit possible in cooling mode. If necessary, the controller limits the setpoint temperature to specific values and prevents an adjustment beyond statutory limits.
- It is possible to convert the command value output value of the room temperature controller function to a control parameter for a rotation angle of a rotary actuator.

Functions of the integrated controller extension

- As an alternative to the function of the room temperature controller, the controller extension can be activated. This allows control of an external room temperature controller.
- Full control of the controller (operating modes, presence functions and setpoint temperature shift).
- Full indication of the controller status by the status LED of the extension (heating/cooling signal, target temperature shift, room temperature, setpoint temperature and current operating mode).
- Room temperature measurement also possible on the extension.

Functions of the integrated push button sensor

- The operating concept can be configured
- The button function can be configured
- The rocker function can be configured

  Switching: The command on pressing and/or releasing is adjustable (no reaction, switch on, switch off, toggle).

  Dimming and colour temperature with switching: The command on pressing, the time between switching and dimming, the dimming in different levels, the telegram repetition on long press and the transmission of a stop telegram at

the end of the press is adjustable.
Dimming and colour temperature with scene recall: As an alternative to switching, a scene can also be recalled with a short press of a button.

Venetian blind / shutter / awning / skylight: The command, when pressed, and the operating concept can be set.

Value transmitter: The data point type | value range and the value can be set. The value adjustment can optionally be activated by long button-actuation.

Scene extension: The scene number can be called up or switched over by briefly pressing the button. Optionally, the storage function is executed by pressing the button longer. Each of the control surfaces can be used as an independent button or – when linked with the opposite button – as a rocker function.

Short and long button actuation: Up to two telegrams can be transmitted to the KNX by pressing the button. The operating concept can be adjusted and the time for short and long actuation adapted. The function of the channels is adjustable separately.

Room temperature control point: The function (operating mode switch-over, forced operating mode switch-over, presence function, setpoint temperature shift, fan control auto/manual and manual fan specification) can be set.
Changing the display: Scroll to display information or call up specific information.

- Full-surface operation can be configured (only for the dimming and colour temperature rocker functions, venetian blinds (in the "Step – Up/down or step" operating sequence) and for short and long button actuation")
  With full-surface operation, switching telegrams and scene recall requests can be triggered on the KNX in addition to and independently of the configured rocker function.
- Disabling function can be activated
  The rockers or buttons can be disabled via a 1-bit object. The following settings are possible: polarity of the disabling object, behaviour at the beginning and at the end of disabling. During an active disable, all or some of the rockers/buttons can have no function, can perform the function of a selected button or execute one of two presettable disabling functions.

LED functions

- The status LED can light up in red, green or blue according to choice. An automatic colour change is also possible depending on the function. When switched-off, the status LEDs can shine in a designed colour, creating an orientation light.
- The brightness of the status LED can be set to five levels. With brightness reduction, the brightness of the status LED can be reduced at night time using a communication object.

– Possible status LED functions include, among others, "always OFF", "always ON", "button-press display", "Status display", "2-colour status display", "Activation via separate LED object", "Operating mode display", "Controller status display", "Comparator without/with sign (1-byte)" and "Fan controller display".
– The operation LED of the TSEM can be permanently on or off or alternatively be switched via a communication object. The operation LED can light up in red, green or blue according to choice.
– All status LEDs of the device can flash simultaneously in the event of an alarm. The following settings are possible: Value of alarm signalling object for the states alarm / no alarm, alarm acknowledge by actuation of a button, transmission of the acknowledge signal to other devices.
– When a status LED is internally connected with the rocker or the button, it can signal a button-press or the current status of a communication object. The status indication can also be in inverted form. When a status LED is not dependent on the rocker or button, it can be permanently on or off, indicate the status of an independent communication object, the operating state of a room temperature controller or the result of a comparison between signed or unsigned 1-byte values.

9 General settings

9.1 Button configuration

The room controller module can be extended to 16 control surfaces using a push-button sensor extension module, if necessary. An extension module expands the number of control surfaces in addition to the control surfaces of the basic unit, so that up to four rockers or 8 buttons more are available.

The rockers or buttons of the extension module are evaluated by the application program of the basic unit. In addition, each operating element of the extension module has a status LED, which is also activated by the application program of the basic device. Consequently, an extension module does not have any application program of its own or a bus coupling unit. The extension module is configured and put into operation in the ETS via the ETS application program of the basic device. Each basic unit can have only one extension module connected to it.
Together, a basic unit and an extension module form a unit.

Configuration of the control surfaces of the connected extension module is carried out in the ETS on the "Configuration TSEM" parameter page.
The button configuration of the basic module is permanently specified by the application program of the basic device used in the ETS project, and cannot be changed (room controller module 2-gang = 2 rockers / buttons 1...4 on the basic device; room controller module 4-gang = 4 rockers / buttons 1...8 on the basic device). If a extension module is connected, the type of the extension module, and with it the number of available buttons, must be enabled separately in the ETS. In the ETS parameter view, the corresponding communication objects and parameters are automatically displayed.

The enabled functions of the extension module are displayed and configured in the ETS in the same way as the rockers or buttons of the basic module.
The button numbers and all further functions for the basic module and extension module are separately displayed and counted.

9.2 Operating concept and button evaluation

Switching over between rocker and button operation of an operating element of the basic or extension module takes place on the "Operating concept" parameter page. The "Operating concept" parameters specify for each control surface whether the opposing buttons are combined into a common rocker function, or are evaluated as two separate button functions.
The additional parameter pages and the communication objects of the rockers or buttons are then also created and adapted depending on the setting parameterized here.

Pressing several rockers or buttons at the same time will be considered as a wrong operation. The special rocker function "Full-surface operation" is an exception to the above rule. In this case, the parameterisation of the rocker decides whether the operation is a wrong operation or not.

The functions of the individual rockers or buttons are set on the parameter pages "Rocker ... (buttons ...)" or "Button ...".

Button pair as rocker function
For rocker functions, the opposing buttons affect the communication objects together. As a rule, actuation of the two buttons then result in directly opposite information (e.g. switching: ON - OFF / venetian blind: UP - DOWN). When a button is actuated, the commands should be made independently of each other.

Full-surface operation with rocker function
Depending on the basic function of a rocker, it is also possible with some settings to use a press on the full surface with a separate function. With full-surface operation, both buttons of a rocker are pressed at the same time.

Button pair as button function
With button operation, the control surfaces are evaluated independently of each other (single-area operation).

9.3 Parameter group "General"

General

Extension module push-button sensor	**Not present** 1-gang (TSEM - buttons 1 and 2 present) 2-gang (TSEM - buttons 1 to 4 present) 3-gang (TSEM - buttons 1 to 6 present) 4-gang (TSEM - buttons 1 to 8 present)
If a push-button sensor extension module is connected to the basic device, it must be enabled at this point.	

Operating concept

Operating concept of buttons 1 and 2 (The same parameters are available for the other control surfaces / button pairs.)	**Rocker function (rocker 1)** Button function
For each respectively opposing buttons, it can be set whether they are to be used combined as a rocker with a common basic function or as two buttons with separate functions. Depending on this setting, the ETS displays different communication objects and parameter pages.	

10 Channel-oriented device functions

The following subchapters provide a description of the device functions. Each subchapter consists of the following sections:

– Functional description
– Table of parameters
– Object list

Functional description

The functional description explains the function and provides helpful tips on project design and usage of the function. Cross references support you in your search for further information.

Table of parameters

The table of parameters lists all parameters associated with the function. Each parameter is documented in a table as follows.

Name of the parameter	Parameter values
Parameter description	

Object list

The object list specifies and describes all communication objects associated with the function. Each communication object is documented in a table.

Function	This column contains the function of the communication object.
Name	This column contains the name of the communication object.
Type	This column contains the length of the communication object.
DPT	This column assigns a datapoint type to a communication object. Datapoint types are standardized in order to ensure interoperability of KNX devices.
Flag	This column assigns the communication flags in accordance with the KNX specification.
C-Flag	activates / deactivates the communication of the communication object
R-Flag	enables externally triggered reading of the value from the communication object
W-Flag	enables externally triggered writing of the value to the communication object
T-Flag	enables transfer of a value
U-Flag	enables updating of an object value in case of feedback
I-Flag	enforces updating of the communication object value when the devices is switched on (reading at init)

10.1 Table of parameters

TSM/TSEM -> Button/rocker … -> Button/Rocker … - Function

Name	max. 40 characters long text
This parameter gives the button/rocker a name for identification. This name serves merely as an aid in the ETS and is not programmed into the device.	

Function	No function **Switching** Dimming and colour temperature with switching Dimming and colour temperature with scene call-up Venetian blind / shutter / awning / roof window Value transmitter Short and long button operation Room temperature control point Change in the display reading
No function: Only visible for operating concept button function. Switching: The command on pressing and/or releasing is adjustable (no reaction, switch on, switch off, toggle). Dimming and colour temperature with switching: switching and changing the brightness or the colour temperature or both. Dimming and colour temperature with scene recall: As an alternative to switching, a scene can also be recalled with a short press of a button. Or you can toggle between two scenes. Venetian blind / shutter / awning / skylight: The command, when pressed, and the operating concept can be set. Value transmitter: The data point type | value range and the value can be set. The value adjustment can optionally be activated by long button-actuation. Scene extension: The scene number can be called up or switched over by briefly pressing the button. Optionally, the storage function is executed by pressing the button longer. Each of the control surfaces can be used as an independent button or – when linked with the opposite button – as a rocker function. Short and long button actuation: Up to two telegrams can be transmitted to the KNX by pressing the button. The operating concept can be adjusted and the time for short and long actuation adapted. The function of the channels is adjustable separately. Room temperature control point: The function (operating mode switch-over, forced operating mode switch-over, presence function, setpoint temperature shift, fan control auto/manual and manual fan specification) can be set. Changing the display: Scroll to display information or call up specific information. Only visible for operating concept button function.	

10.2 Switching

For each rocker or button whose function is set to "switching", the ETS shows up to two 1-bit communication objects. The parameters permit fixing the value the "switching" object is to assume on pressing and/or releasing (ON, OFF, TOGGLE – toggling of the object value). No distinction is made between a brief or long press.

10.2.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

When pressed	No reaction ON OFF **TOGGLE**
This parameter defines the reaction when the button is pressed.	

When released	**No reaction** ON OFF TOGGLE
This parameter defines the reaction when the button is released.	

10.2.2 Object list

The following communication objects are available for the individual rockers or buttons, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be adjusted by the "Name" parameter.

Function	Name	Type	DPT	Flag
Switching	Button/rocker *n* - output	1-bit	1,001	C, R, -, T, A
1-bit object for transmission of switching telegrams (ON, OFF).				

Function	Name	Type	DPT	Flag
Switching - Status	Button/rocker *n* - input	1-bit	1,001	C, -, W, -, U
1-bit object for receiving feedback telegrams (ON, OFF). This object is visible if the "When pressed" parameter or "When released" parameter is configured to "TOGGLE".				

10.3 Dimming and colour temperature with switching

For each rocker or button whose function is set to "dimming and colour temperature" with switching, the ETS shows up to two 1-bit objects and one 4-bit or 3-byte object. Generally, the device transmits a switching telegram after a brief actuation and a dimming telegram after a long actuation. In the standard parameterisation the device transmits a telegram for stopping the dimming action after a long actuation. The time required by the device to detect the actuation as long actuation can be set in the advanced parameters. The brightness or the colour temperature can be dimmed.

Status

If an actuator is controlled by multiple control points, the actuator must report its switching status to the 1-bit object "switching status" of the button or rocker. Due to the feedback, the device detects that the actuator has changed its switching status by input from another element and adjusts the dimming direction accordingly. The status is visible only if switchover commands are set.

The dimming direction is always only evaluated and switched locally, unless the actuator changes its switching status due to input from multiple elements (e.g. lighting ON / change of brightness value only). The 4-bit dimming objects and the 3-byte combi object are not tracked via the bus.

Advanced configuration options

The device has advanced parameters for the dimming function. If necessary, these advanced parameters can be activated and thus be made visible.

The configurable “time between switching and dimming“ is used to set how long the button must be pressed until dimming telegrams are sent out.

The advanced parameters can be used to determine whether the device is to cover the full adjusting range of the actuator with one dimming telegram continuously ("Increase brightness / colour temperature colder by 100%", "Reduce brightness / colour temperature warmer by 100%") or whether the dimming range is to be divided into several small levels (50%, 25%, 12.5%, 6%, 3%, 1.5%).

In the continuous dimming mode (100%), the device transmits a telegram only at the beginning of the long press to start the dimming process and generally a stop telegram after the end of the press. For dimming in small levels it may be useful if the device repeats the dimming telegram in case of a sustained press for a presettable time (parameter "Telegram repetition"). The stop telegram after the end of the press is then not needed.

i When the parameters are hidden ("Advanced parameters = deactivated"), the dimming range is set to 100%, the stop telegram is activated and the telegram repetition is deactivated.

10.3.1 Brightness

The brightness is dimmed in the default configuration.

The control of the brightness in the "Dimming and colour temperature" function distinguishes between dual-area operation and single-area operation. The parameter "Brightness on pressing" defines the single-area or dual-area dimming function.

Dual-area operation	Single-area operation
Brighter (ON)	Brighter/darker (TOGGLE)
Darker (OFF)	Brighter (TOGGLE)
	Darker (TOGGLE)

With dual-area operation, the device transmits a telegram for switching on or off after a brief actuation, and a telegram for increasing the brightness ("Brighter") or dimming ("Darker") after a long actuation.

With single-area operation, the device transmits ON and OFF telegrams in an alternating pattern ("TOGGLE") for each brief actuation, and the "brighter" and "darker" telegrams in an alternating pattern for long actuation of the respective button.

10.3.2 Colour temperature

The "Dimming and colour temperature" function with the control of the colour temperature distinguishes between dual-area operation and single-area operation. The parameter "Colour temperature on pressing" defines the single-surface or double-surface dimming function.

Dual-area operation	Single-area operation
Colder (ON)	Colder / warmer (TOGGLE)
Warmer (OFF)	Colder (TOGGLE)
	Warmer (TOGGLE)

With dual-area operation, the device sends a telegram for switching on or off after short actuation and a telegram for dimming the telegram to a colder or warmer colour temperature.

With single-area operation, the device sends switch-on and switch-off telegrams alternately ("TOGGLE") each time the respective button is pressed briefly and "colder colour temperature" and "warmer colour temperature" telegrams alternately in the event of long actuation.

10.3.3 Brightness and colour temperature

The dimming process can only adjust either the brightness or the colour temperature via individual objects.

Optionally, the brightness and the colour temperature can also be adjusted together via a combi object.

The "Dimming and colour temperature" function with the control of the brightness and colour temperature distinguishes between dual-area operation and single-area operation. The parameter "Brightness + colour temperature on pressing" defines the single-area or dual-area dimming function.

Dual-area operation	Single-area operation
Brighter + colder (ON)	Brighter + colder / darker + warmer (TOGGLE)
Darker + warmer (OFF)	Brighter + colder (TOGGLE)
	Darker + warmer (TOGGLE)

In dual-area operation, the device sends a telegram for switching on or off in the event of brief actuation and a telegram for brighter/colder or darker/warmer dimming in the event of long actuation.

In single-area operation, the device sends switch-on and switch-off telegrams alternately ("TOGGLE") in the event of brief actuation and the "brighter + colder" and "darker + warmer" telegrams alternately in the event of long actuation of the respective button.

10.3.4 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Dimming control	**Single object: brightness** Single object: colour temperature Combi object: brightness + colour temperature
With this parameter, either the brightness or the colour temperature can be dimmed by means of an individual object, or the brightness and colour temperature can be controlled together by means of a combination object	

Brightness on pressing	No reaction **Brighter (ON)** Darker (OFF) Brighter/darker (TOGGLE) Brighter (TOGGLE) Darker (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = individual object: brightness	

Colour temperature on pressing	No reaction **Colder (ON)** Warmer (OFF) Colder / warmer (TOGGLE) Colder (TOGGLE) Warmer (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = individual object: colour temperature	

Brightness + colour temperature on pressing	No reaction **Brighter + colder (ON)** Darker + warmer (OFF) Brighter + colder / darker + warmer (TOGGLE) Brighter + colder (TOGGLE) Darker + warmer (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = combination object: brightness + colour temperature	

Extended settings	Active **Inactive**
When the advanced parameters are activated, the ETS shows the following parameters.	

Time between switching and dimming	**0** ... 50 s | 100 ... **400** ... 990 ms
This parameter defines how long the button must be pressed for a dimming telegram to be transmitted.	

Dim brightness by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the brightness is increased. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Dimming darker by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the brightness is reduced. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Colour temperature colder by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the colour temperature is increased. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Colour temperature warmer by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the colour temperature is reduced. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Stop telegram	**Active** Inactive
On "Active" the device transmits a telegram for stopping the dimming process when the button is released. When the device transmits telegrams for dimming in smaller levels, the stop telegram is generally not needed.	

Telegram repetition	Active **Inactive**
This parameter can be used to activate telegram repetition for dimming. With telegram repetition activated, the device cyclically sends relative dimming telegrams (in the parameterised step width) to the bus if the button is pressed long.	

Time between two telegrams	**200 ms** 300 ms 400 ms 500 ms 750 ms 1000 ms 2000 ms
This parameter defines the interval at which the dimming telegrams are automatically repeated in the telegram repetition mode. This parameter is only visible if "Telegram repetition = active"!	

10.3.5 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Dimming - Switching	Button/rocker *n* - output	1-bit	1,001	C, R, -, T, A
1-bit object for transmission of switching telegrams (ON, OFF).				

Function	Name	Type	DPT	Flag
Dimming	Button/rocker *n* - output	4-bit	3,007	C, R, -, T, A
4-bit object for sending relative dimming telegrams to adjust the brightness.				

Function	Name	Type	DPT	Flag
Dimming - Brightness and colour temperature	Button/rocker *n* - output	3-byte	250,600	C, R, -, T, A
3-byte object for sending dimming telegrams for adjusting the brightness and the colour temperature in combination.				

Function	Name	Type	DPT	Flag
Dimming - Switching - Status	Button/rocker *n* - input	1-bit	1,001	C, -, W, -, U
1-bit object for receiving feedback telegrams (ON, OFF). Visible only for switchover commands (TOGGLE).				

Function	Name	Type	DPT	Flag
Dimming - Colour temperature fading	Button/rocker *n* - output	4-bit	3,007	C, R, -, T, A
4-bit object for sending relative dimming telegrams to adjust the colour temperature.				

10.4 Dimming and colour temperature with scene call-up

For each rocker or button whose function is set to "dimming and colour temperature with scene recall", the ETS shows up to one 1-bit object, one 1-byte object and one 4-bit or 3-byte object. Generally, the device transmits a scene telegram after a brief actuation and a dimming telegram after a long actuation. In the standard parameterisation the device transmits a telegram for stopping the dimming action after a long actuation. The time required by the device to detect the actuation as long actuation can be set in the advanced parameters. The brightness or the colour temperature can be dimmed individually or both simultaneously.
A scene recall can be parametrised for the ON command or for the OFF command, or with a toggle parametrisation also a scene number for ON and OFF command.

Advanced configuration options

The device has advanced parameters for the dimming function. If necessary, these advanced parameters can be activated and thus be made visible.

The configurable “time between switching and dimming“ is used to set how long the button must be pressed until dimming telegrams are sent out.

The advanced parameters can be used to determine whether the device is to cover the full adjusting range of the actuator with one dimming telegram continuously ("Increase brightness / colour temperature colder by 100%", "Reduce brightness / colour temperature warmer by 100%") or whether the dimming range is to be divided into several small levels (50%, 25%, 12.5%, 6%, 3%, 1.5%).

In the continuous dimming mode (100%), the device transmits a telegram only at the beginning of the long press to start the dimming process and generally a stop telegram after the end of the press. For dimming in small levels it may be useful if the device repeats the dimming telegram in case of a sustained press for a presettable time (parameter "Telegram repetition"). The stop telegram after the end of the press is then not needed.

i When the parameters are hidden ("Advanced parameters = deactivated"), the dimming range is set to 100%, the stop telegram is activated and the telegram repetition is deactivated.

10.4.1 Brightness

The brightness is dimmed in the default configuration.

The control of the brightness in the "Dimming and colour temperature" function distinguishes between dual-area operation and single-area operation. The parameter "Brightness on pressing" defines the single-area or dual-area dimming function.

Dual-area operation	Single-area operation
Brighter (ON)	Brighter/darker (TOGGLE)
Darker (OFF)	Brighter (TOGGLE)
	Darker (TOGGLE)

With dual-area operation, the device transmits a telegram for switching on or off after a brief actuation, and a telegram for increasing the brightness ("Brighter") or dimming ("Darker") after a long actuation.

With single-area operation, the device transmits ON and OFF telegrams in an alternating pattern ("TOGGLE") for each brief actuation, and the "brighter" and "darker" telegrams in an alternating pattern for long actuation of the respective button.

10.4.2 Colour temperature

The "Dimming and colour temperature" function with the control of the colour temperature distinguishes between dual-area operation and single-area operation. The parameter "Colour temperature on pressing" defines the single-surface or double-surface dimming function.

Dual-area operation	Single-area operation
Colder (ON)	Colder / warmer (TOGGLE)
Warmer (OFF)	Colder (TOGGLE)
	Warmer (TOGGLE)

With dual-area operation, the device sends a telegram for switching on or off after short actuation and a telegram for dimming the telegram to a colder or warmer colour temperature.

With single-area operation, the device sends switch-on and switch-off telegrams alternately ("TOGGLE") each time the respective button is pressed briefly and "colder colour temperature" and "warmer colour temperature" telegrams alternately in the event of long actuation.

10.4.3 Brightness and colour temperature

The dimming process can only adjust either the brightness or the colour temperature via individual objects.

Optionally, the brightness and the colour temperature can also be adjusted together via a combi object.

The "Dimming and colour temperature" function with the control of the brightness and colour temperature distinguishes between dual-area operation and single-area operation. The parameter "Brightness + colour temperature on pressing" defines the single-area or dual-area dimming function.

Dual-area operation	Single-area operation
Brighter + colder (ON)	Brighter + colder / darker + warmer (TOGGLE)
Darker + warmer (OFF)	Brighter + colder (TOGGLE)
	Darker + warmer (TOGGLE)

In dual-area operation, the device sends a telegram for switching on or off in the event of brief actuation and a telegram for brighter/colder or darker/warmer dimming in the event of long actuation.

In single-area operation, the device sends switch-on and switch-off telegrams alternately ("TOGGLE") in the event of brief actuation and the "brighter + colder" and "darker + warmer" telegrams alternately in the event of long actuation of the respective button.

10.4.4 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Dimming control	**Single object: brightness** Single object: colour temperature Combi object: brightness + colour temperature
With this parameter, either the brightness or the colour temperature can be dimmed by means of an individual object, or the brightness and colour temperature can be controlled together by means of a combination object	

Brightness on pressing	No reaction **Brighter (ON)** Darker (OFF) Brighter/darker (TOGGLE) Brighter (TOGGLE) Darker (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = individual object: brightness	

Colour temperature on pressing	No reaction **Colder (ON)** Warmer (OFF) Colder / warmer (TOGGLE) Colder (TOGGLE) Warmer (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = individual object: colour temperature	

Brightness + colour temperature on pressing	No reaction **Brighter + colder (ON)** Darker + warmer (OFF) Brighter + colder / darker + warmer (TOGGLE) Brighter + colder (TOGGLE) Darker + warmer (TOGGLE)
This parameter defines the reaction when a button is pressed. If the device is to toggle on a brief press, the corresponding switching objects of other sensors with the same function must be interlinked. This parameter is visible only if: dimming control = combination object: brightness + colour temperature	

Scene number for "ON"	**1** … 64
If a switch-on command occurs, the scene number entered here is called up. This parameter is only visible with the setting "...when pressed" is set to (ON) or (TOGGLE).	

Scene number for "OFF"	1, **2** … 64
If a switch-off command occurs, the scene number entered here is called up. This parameter is only visible with the setting "...when pressed" is set to (OFF) or (TOGGLE).	

Extended settings	Active **Inactive**
When the advanced parameters are activated, the ETS shows the following parameters.	

Time between switching and dimming	**0** ... 50 s | 100 ... **400** ... 990 ms
This parameter defines how long the button must be pressed for a dimming telegram to be transmitted.	

Dim brightness by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the brightness is increased. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Dimming darker by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the brightness is reduced. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Colour temperature colder by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the colour temperature is increased. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Colour temperature warmer by	1.5 % 3 % 6 % 12.5 % 25 % 50 % **100 %**
This parameter sets the relative dimming level when the colour temperature is reduced. On each button actuation, the brightness is changed at maximum by the configured step width. It is recommended that the device repeats the dimming telegrams automatically, particularly with a small dimming level (see "Telegram repetition").	

Stop telegram	**Active** Inactive
On "Active" the device transmits a telegram for stopping the dimming process when the button is released. When the device transmits telegrams for dimming in smaller levels, the stop telegram is generally not needed.	

Telegram repetition	Active **Inactive**
This parameter can be used to activate telegram repetition for dimming. With telegram repetition activated, the device cyclically sends relative dimming telegrams (in the parameterised step width) to the bus if the button is pressed long.	

Time between two telegrams	**200 ms** 300 ms 400 ms 500 ms 750 ms 1000 ms 2000 ms
This parameter defines the interval at which the dimming telegrams are automatically repeated in the telegram repetition mode. This parameter is only visible if "Telegram repetition = active"!	

10.4.5 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Dimming - Scene number	Button/rocker *n* - output	1-byte	18,001	C, R, -, T, A
1-bit object for transmission of switching telegrams (ON, OFF).				

Function	Name	Type	DPT	Flag
Dimming	Button/rocker *n* - output	4-bit	3,007	C, R, -, T, A
4-bit object for sending relative dimming telegrams to adjust the brightness.				

Function	Name	Type	DPT	Flag
Dimming - Brightness and colour temperature	Button/rocker *n* - output	3-byte	250,600	C, R, -, T, A
3-byte object for sending dimming telegrams for adjusting the brightness and the colour temperature in combination.				

Function	Name	Type	DPT	Flag
Dimming - Colour temperature fading	Button/rocker *n* - output	4-bit	3,007	C, R, -, T, A
4-bit object for sending relative dimming telegrams to adjust the colour temperature.				

10.5 Venetian blind / shutter / awning / roof window

Operating concept for the venetian blind function

For the control of Venetian blind, roller shutter, awning or similar drives, the device supports four operating concepts in which the telegrams are transmitted in different time sequences. The device can therefore be used to operate a wide variety of drive configurations.

"Step - Up/down - Step" operating concept:
When selecting the operating concept "Step – Up/down – Step", the device behaves as follows:

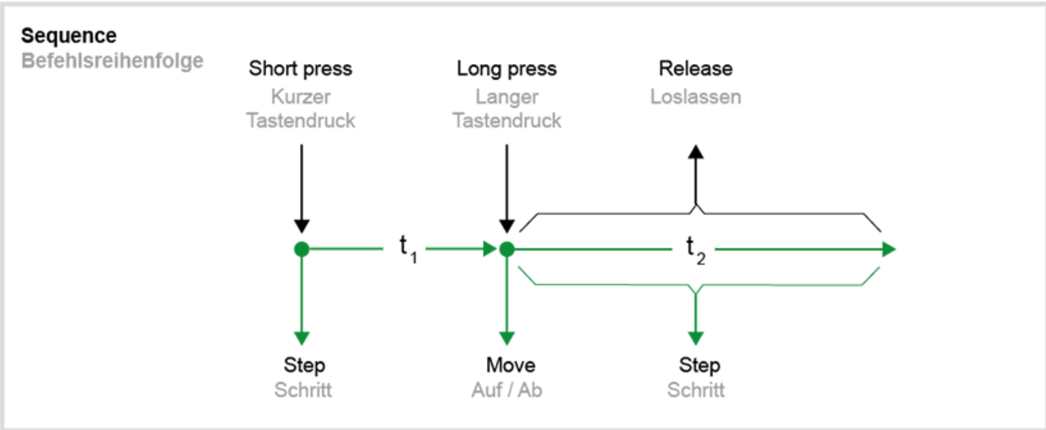

Figure 35: "Step - Up/down - Step" operating concept

- Immediately on pressing the button, the device transmits a short time telegram. This stops a running drive and starts the time t1 ("long button actuation"). No other telegram will be sent if the button is released within t1. This short time serves the purpose of stopping a continuous movement.
  The time "long button actuation from" selected in the device should be shorter than the short time operation of the actuator to prevent jerky motion of the Venetian blind.
- If the button is kept depressed for longer than t1, the push-button will send a long-time telegram at the end of t1 to move the drive, and the time t2 ("slat adjustment time window") will be started.
- If the button is released within the time window, the device will send another short-time telegram. This function is used for adjusting the slats of a Venetian blind. The function permits stopping the slats in any position during their rotation.
  The "slat adjustment time window" should be chosen as required by the drive to completely rotate the slats. If the selected "slat adjustment time window" is longer than the complete running time of the drive, a pushbutton function is possible as well. This means that the drive is active only when the button is kept depressed.
- If the button is kept depressed for longer than t2, the device will not send another telegram. The drive remains on until the end position is reached.

"Up/down - Step" operating concept:
If the operating concept "Up/down – Step" is selected, the device behaves as follows:

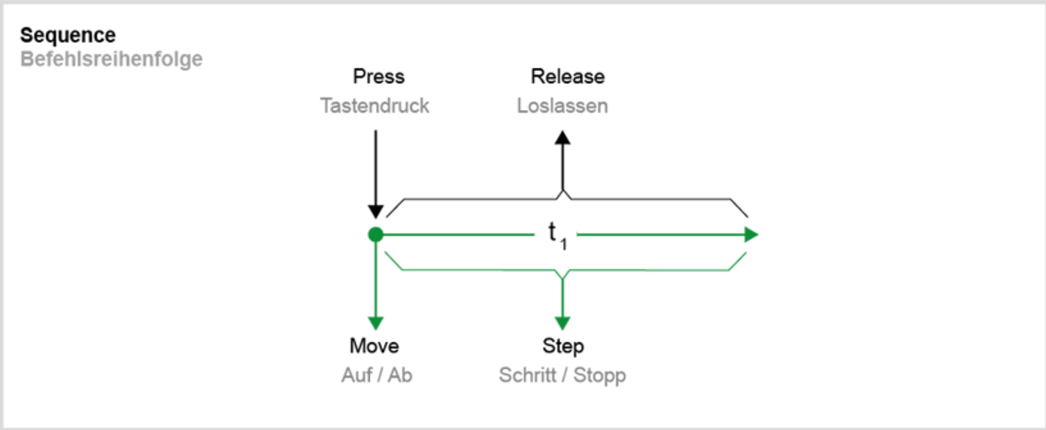

Figure 36: "Up/down - Step" operating concept

– Immediately on pressing the button, the device transmits a long time telegram. The drive begins to move and the time t1 ("slat adjustment time window") is started.
– If the button is released within the slat adjustment time window, the device will send a short-time telegram. This function is used for adjusting the slats of a Venetian blind. The function permits stopping the slats in any position during their rotation.
  The "slat adjustment time window" should be chosen as required by the drive to completely rotate the slats. If the selected "slat adjustment time window" is longer than the complete running time of the drive, a pushbutton function is possible as well. This means that the drive is active only when the button is kept depressed.
– If the button is kept depressed for longer than t1, the device will not send another telegram. The drive remains on until the end position is reached.

"Step - Up/down" operating concept:
If the operating concept "Step – Up/down" is selected, the device will behave as follows:

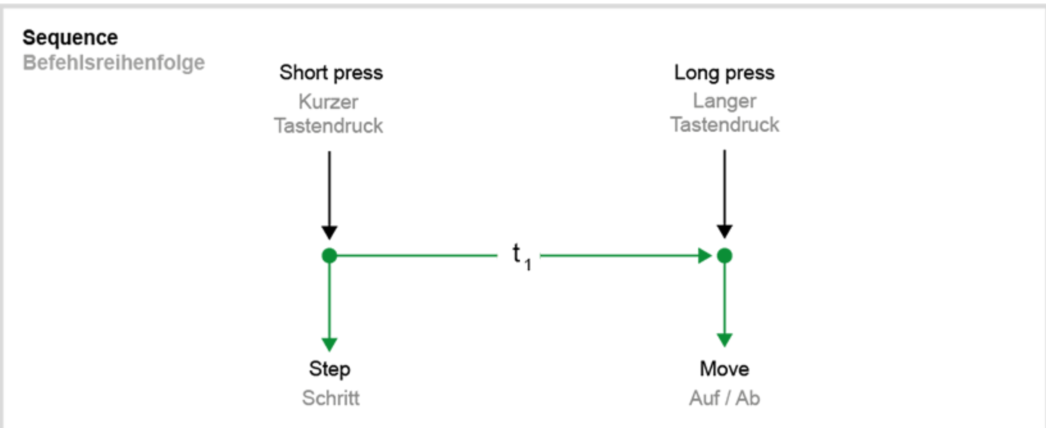

Figure 37: "Step - Up/down" operating concept

– Immediately on pressing the button, the device transmits a short time telegram. This stops a running drive and starts the time t1 ("long button actuation"). No other telegram will be sent if the button is released within t1. This short time serves the purpose of stopping a continuous movement.
The time "long button actuation from" selected in the device should be shorter than the short time operation of the actuator to prevent jerky motion of the Venetian blind.
– If the button is kept depressed for longer than t1, the push-button will transmit a long-time telegram to start the drive at the end of t1.
– No further telegram is transmitted when the push-button is released. The drive remains on until the end position is reached.

"Up/down - Step or step" operating concept:
If the operating concept "Up/down – Step or step" is selected, the device will behave as follows:

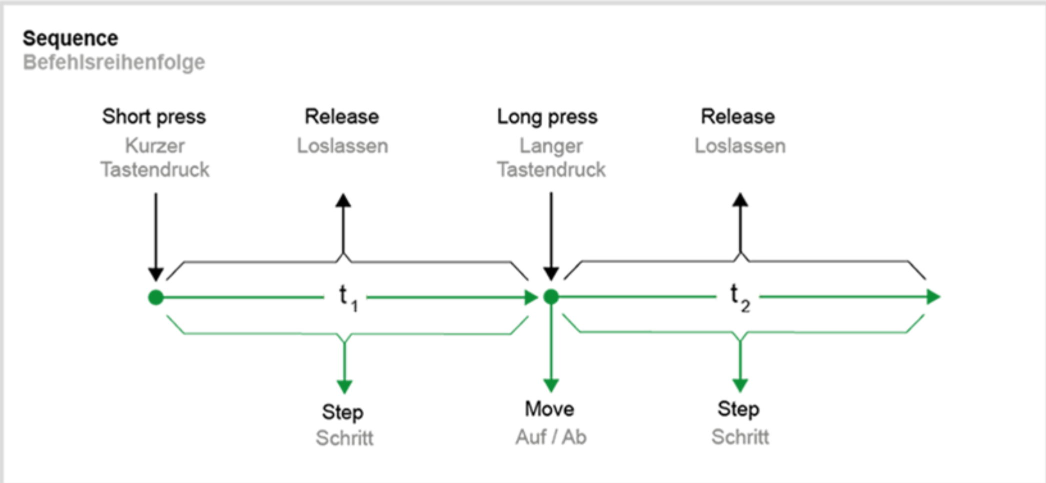

Figure 38: "Up/down – Step or step" operating concept

– Immediately after pressing the button, the device starts the time t1 ("long button actuation") and waits. If the button is released again before t1 expires, the device will send a short-time telegram. This telegram can be used to stop a running drive. A stationary drive rotates the slats by one level.
– If the button is kept depressed after t1 expires, the device will send a long-time telegram and start the time t2 ("slat adjustment time window").
– If the button is released within t2, the device will send another short-time telegram. This function is used for adjusting the slats of a Venetian blind. The function permits stopping the slats in any position during their rotation.
The "slat adjustment time window" should be chosen as required by the drive to completely rotate the slats. If the selected "slat adjustment time window" is longer than the complete running time of the drive, a pushbutton function is possible as well. This means that the drive is active only when the button is kept depressed.
– If the button is kept depressed for longer than t2, the device will not send another telegram. The drive remains on until the end position is reached.

In this operating concept, the device will not transmit a telegram immediately after depressing one button of the rocker. This principle permits detecting a full-surface operation when the sensor is configured as a rocker.

Full-surface operation with venetian blind function

If a rocker is configured for venetian blind / shutter / awning / skylight operation and the operating concept "Step - Up/down or step" is used, the device will need some time at the beginning of each operation to distinguish between short and long operation. When full-surface operation is enabled, the device can make use of this time span to evaluate the otherwise invalid simultaneous actuation of both buttons of a rocker.

Full-surface operation of a rocker is detected by the device when both buttons are pressed at the same time. When the device has detected a valid full-surface operation, the status LED flashes quickly at a rate of about 8 Hz for the duration of the actuation. Full-surface operation must have been detected before the first telegram has been transmitted by the venetian blind function (short time or long time). If this is not so (e.g. one of the two buttons is pressed too late), the full-surface operation will not be correctly executed.

Full-surface operation is independent. It has up to two communication objects and can optionally be used for switching (ON, OFF, TOGGLE – toggling of the object value) or for scene recall or switchover between two scene numbers. This can be done without or with the storage function. In the last case, the full-surface actuation on causes a scene to be recalled in less than a second. If the device is to send the telegram for storing a scene, full-surface actuation must be maintained for more than five seconds. If full-surface actuation ends between the first and the fifth second, the device will not send any telegrams.

For each rocker or button whose function is set to "venetian blind / shutter / awning / skylight" the ETS shows the two 1-bit objects "short time operation" and "long time operation".

The “Type of blind/shutter“ parameter can be used to select whether “Venetian blind“ or “shutter / awning / skylight“ are to be controlled. The “command sequence“ parameters are changed, depending on the setting.

The "Venetian blind / shutter / awning / skylight" function distinguishes between dual-area operation (UP, DOWN) and single-area operation (TOGGLE). The "Command on pressing" parameter defines the single-area or double-area blind function.

Dual-area operation	Single-area operation
UP	TOGGLE
DOWN	

With an operating element as a rocker, the double-surface Venetian blind function is preset. This means that the device e.g. with a press of the left button, transmits a telegram for an upward movement and, after a press of the right button, transmits a telegram for a downward movement.

In the case of an operating element as buttons, the single-area Venetian blind principle is preset. In this case, the device alternates between the directions of the long time telegram (TOGGLE) on each long actuation of the sensor. Several short time telegrams in succession have the same direction.

Status

If the actuator can be controlled from several sensors, a faultless single-area operation requires that the long time objects of the control elements are interlinked. The device would otherwise not be able to detect that the actuator has been addressed from another sensor, in which case it would have to be actuated twice during the next use in order to produce the desired reaction.

10.5.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Type of blind/shutter	Blind **Shutter / awning / roof window**
This parameter defines the type of blind/shutter to be controlled and optimises the available setting options of the channel function.	

Command on pressing	UP DOWN **TOGGLE**
This parameter defines the running direction of the drive on pressing the button. If the setting is "TOGGLE", the direction is changed after each long time command. If several devices are to control the same drive, the long time objects of the devices must be interlinked to ensure that the running direction can be changed correctly.	

Command sequence	Up/down - Step **Step - Up/down**
Two different operating concepts can be selected to actuate the "shutter / awning / roof window" blind/shutter types.	

Command sequence	**Step - Up/down - Step** Up/down - Step Step - Up/down Step - Up/down or step
For Venetian blind control, four different operating concepts can be selected.	

Long button actuation from (t1)	**0** ... 59 s | 100 ... **400** ... 990 ms
This parameter sets the time after which the long-time operation will be evaluated on pressing the button. This parameter is not visible for the "command sequence = Up/down - Step"	

Time window for slat adjustment (t2)	**0** ... 59 s | 0 ... **500** ... 990 ms
The time during which a transmitted MOVE telegram can be terminated by releasing the button (STEP) is set here. This function serves to adjust the slats of a venetian blind. This parameter is not visible for the "command sequence = Step - Up/down"	

Show info graphic	**Active** Inactive
With activated info graphic, the graphic diagram of the command sequence and related text information are displayed.	

Full-surface operation	Active Inactive
When the full-surface operation is activated, the ETS shows the following parameters. Full-surface operation can be configured only if operating concept = "rocker function" and command sequence = "Step - Up/down or step"!	

Function	Switching Scene extension
In case of full-surface operation, this parameter defines the function that is to be used. The ETS shows the corresponding communication object and the other parameters. This parameter is only visible if "Full-surface actuation = Active"!	

Command	ON OFF TOGGLE
This parameter defines the value of the transmitted telegram when a full-surface operation has been sensed. "TOGGLE" changes over the current object value. This parameter is only visible if "function for full-surface operation = Switching"!	

Short button actuation for scene extension	Recall scene Switch over scene
Whether a scene is called up or two scenes are switched to and fro when the full surface of the button is pressed is set here. This parameter is visible only if "function in the event of full-surface operation = scene extension"!	

Scene number	1, 2 ... 64
This parameter defines the scene number, which is to be transmitted to the bus after a scene recall or during storage of a scene. If switching a scene is configured, you can switch between two scene numbers each time you press the full surface of the button. This parameter is visible only with "function in the event of full-surface operation = scene extension" and the "Recall scene" setting!	

First scene number	1, 2 ... 64
The first of two scene numbers that you can switch between when pressing the full surface of the button is selected here. This parameter is visible only with "function in the event of full-surface operation = scene extension" and the "Switch over scenes" setting.	

Second scene number	1, **2** ... 64
The second of two scene numbers that you can switch between when pressing the full surface of the button is selected here. This parameter is visible only with "function in the event of full-surface operation = scene extension" and the "Switch over scenes" setting.	

Long button operation	**No reaction** Memory function
Storage function: sends a request to the receiver to store his current state in this scene if the button is pressed and held (5 s). This parameter is visible only if "function in the event of full-surface operation = scene extension"!	

10.5.2 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Venetian blind - Short time operation	Button/rocker *n* - output	1-bit	1,007	C, R, -, T, A
1-bit object for the transmission of telegrams with which a venetian blind or shutter drive motor can be stopped or with which the blind slats can be adjusted by short time operation.				

Function	Name	Type	DPT	Flag
Venetian blind - Long time operation	Button/rocker *n* - output	1-bit	1,008	C, R, -, T, A
1-bit object for the transmission of telegrams with which a venetian blind or shutter drive motor can be can be moved upwards or downwards.				

Function	Name	Type	DPT	Flag
Switching	Rocker *n* - Full-surface operation - Output	1-bit	1,001	C, R, -, T, A
1-bit object for the transmission of switching telegrams (ON, OFF) when there is full-surface operation.				

Function	Name	Type	DPT	Flag
Switching - Status	Rocker *n* - Full-surface operation - Input	1-bit	1,001	C, -, W, -, U
1-bit object for receiving status telegrams (ON, OFF) with full-surface operation.				

Function	Name	Type	DPT	Flag
Scene extension - Scene number	Rocker *n* - Full-surface operation - Output	1-byte	18,001	C, R, -, T, A
1-byte object for recalling, switching over or storing one of a maximum of 64 scenes at a scene push-button sensor with full-surface operation.				

10.6 Value transmitter

With the "value transmitter" function, the device sends parameterised values to the bus at the press of a button. In case of a rocker function, different values can be configured for both buttons.

Value ranges

The value transmitter knows 14 different value ranges. The parameter "Data point type | Value range" determines the value range used by the value transmitter, depending on the application case:

Function	Function	Lower numerical limit	Upper numerical limit
1-byte value transmitter	0...100%	0%	100%
1-byte value transmitter	0...255	0	255
1-byte value transmitter	0…360°	0°	360°
1-byte value transmitter	0...255%	0%	255%
1-byte value transmitter	-128...127	-128	127
2-byte value transmitter	0...65535	0	65535
2-byte value transmitter	Colour temperature value	1000 K	10000 K
2-byte value transmitter	-32768...32767	-32768	32767
2-byte value transmitter	Temperature value	0 °C	40 °C
2-byte value transmitter	Brightness value	0 lux	1500 lux
6-byte value transmitter	Colour temperature value + brightness	1000 K | 0%	10000 K | 100%
3-byte value transmitter	RGB/HSV with colour wheel sequence	#000000	#FFFFFF
6-byte value transmitter	RGB/HSV with brightness adjustment	#000000 + 0	#FFFFFF + 255
6-byte value transmitter	Colour value RGBW/HSVW	#000000 + 0	#FFFFFF + 255

For each of these ranges, the value that can be transmitted to the bus for each button actuation is configurable.

Value adjustment

By activating the "Value adjustment" parameter, further parameters used to configure the value adjustment are displayed in the ETS.

The button for adjusting the value must be kept depressed longer than the configured time period after pressing the button until the start of the adjustment in order to vary the current value of the value transmitter. The value adjustment function continues until the button is released again.

– With the 1-byte and 2-byte value transmitter functions the value is adjusted across the entire number range.
– With the 3-byte value transmitter function in the function RGB/HSV with colour wheel adjustment, the colour hue (H) is adjusted in the range from 0 to 360°.
– With the 3-byte value transmitter function in the RGB / HSV function with brightness adjustment, the brightness value (V) is adjusted in the range from 0 to 100%.

With the 1-byte and 2-byte value transmitter functions, it is possible to set the minimum and maximum limit values to restrict the adjustment range.

The following two examples show the function of the value adjustment with and without overflow:

Example 1: Value adjustment without overflow
- Data point type | value range = DPT 5.010 | 0 ... 255)
- Value when pressed = 227
- Step width = 5
- Start value = same as configured value
- Direction = toggling (alternating)
- Time between two telegrams = 0.5 s

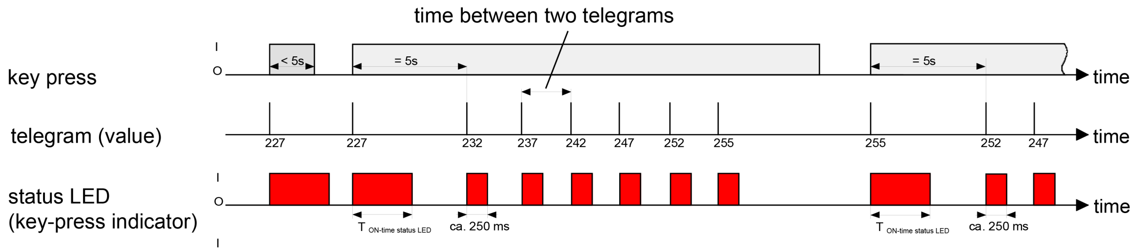

Figure 39: Example of value adjustment without value range overflow

Example 2: Value adjustment with overflow
- Data point type | value range = DPT 5.010 | 0 ... 255
- Value when pressed = 227
- Step width = 5
- Start value = same as configured value
- Direction = toggling (alternating)

Example 2: Value adjustment with overflow
- Time between two telegrams = 0.5 s

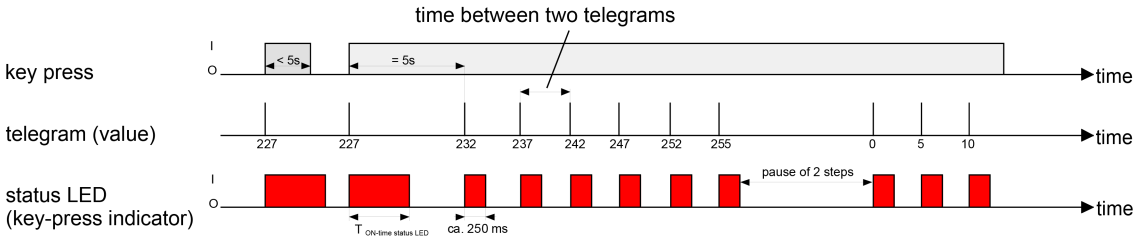

Figure 40: Example of value adjustment with value range overflow

The value adjustment is not available for the data point type | value range "colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)" and "DPT 249.600 | colour temperature value + brightness".

During a value adjustment, the newly adjusted values are only in the volatile RAM memory of the extension module. The stored values are thereby replaced by the preset values programmed in the ETS when a reset of the device occurs (bus voltage failure or ETS programming).

During a value adjustment, a status LED parameterised for the "actuation display" function flashes for each newly sent value if this button is assigned to the status LED for value adjustment.

If the starting value of the communication object is used, it may happen in this case during value adjustment that the value last received via the object must be rounded and adapted before a new value can be calculated on the basis of the step width and transmitted. Due to the computation procedure used, the new calculation of the value may be slightly inaccurate.

10.6.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Data point type | Value range	DPT 5.001 | 0 ... 100% **DPT 5.010 | 0 ... 255** DPT 5.003 | 0 ... 360° DPT 5.004 | 0 ... 255% DPT 6.010 | -128 ... 127 DPT 7.001 | 0 ... 65535 DPT 7.600 | 1000 ... 10000 K DPT 8.001 | -32768 ... 32767 DPT 9.001 | 0 ... 40 °C DPT 9.004 | 0 ... 1500 lux DPT 249.600 | Colour temperature value + brightness RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001) RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001) Colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)
The "value transmitter" function distinguishes between 1-byte, 2-byte 3-byte and 6-byte values. The following parameters and their settings depend on the setting for this parameter.	

Value when pressed	**0** ... 100%
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".	

Value when pressed	**0** ... 255
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.010 | 0 ... 255".	

Value when pressed	**0** ... 360°
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.003 | 0 ... 360°".	

Value when pressed	**0** ... 255%
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.004 | 0 ... 255%".	

Value when pressed	-128...**0** ...127
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 6.010 | -128 ... 127".	

Value when pressed	**0** ... 65535
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 7.001 | 0 ... 65535".	

Colour temperature value when pressed	1000 ... **2700** ... 10000 K
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 7.600 | 1000 ... 10000 K".	

Value when pressed	-32768 ... **0** ... 32767
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 8.001 | -32768 ... 32767".	

Temperature value when pressed	0 ... **20** ... 40 °C
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 9.001 | 0 ... 40°C".	

Brightness value when pressed	0, 50 ... **300** ... 1500 lux
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 9.004 | 0 ... 1500 lux".	

Colour temperature value when pressed	1000 ... **2700** ... 10000 K
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 249.600 | colour temperature value + brightness".	

Brightness value when pressed	**0** ... 100%
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 249.600 | colour temperature value + brightness".	

Adjustment duration in the actuator	0 ... 100 min, 0, **1** ... 59 s, 0 ... 900 ms
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 249.600 | colour temperature value + brightness".	

Colour value when pressed	#000000 ... **#FFFFFF**
This parameter determines the object values of the value transmitter 3-byte (or value transmitter 6-byte), brightness value (V), saturation (S) and colour hue (H) objects when the button is pressed. It is visible with "data point type | value range = RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)", "data point type | value range = RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)" and "data point type | value range = colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)". The value (RGB/HSV) is configured by means of a colour picker. With the data point type | value range "colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)", the white value is configured by means of a separate slider.	

White value	0 ... **255**
This parameter defines the object value of the white level (W) object when the button is pressed. It is visible only if "data point type | value range = colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)".	

Value adjustment	Active **Inactive**
If the value adjustment is activated, the ETS shows further parameters. If a status LED is configured for the "actuation display" function and is assigned to the button for value adjustment, then this flashes during a value adjustment. The status LED symbolises that a new telegram has been transmitted. The value adjustment is not available for the data point type | value range "colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)" and "DPT 249.600 | colour temperature value + brightness".	

Start value	Same as configured value Same as value after last adjustment Like value from status object
Value adjustment can begin with different starting values. With "Same as parameterised value": After each press, the device always starts with the value configured in the ETS. With "Same as value after last adjustment": After a press, the device starts with the value transmitted by itself or by another device with this group address as the last value. With "same as value from status object": the device starts when operated with the value from the status object. This parameter is visible only if "value adjustment = active"! The start value of the value adjustment is different for both buttons of a rocker if the setting is "Same as value after last adjustment". If the value adjustment works for both push-buttons of a rocker and therefore the last rocker adjustment is to be taken into account, the setting "same as value from status object" must be configured. This selection is available only with the data point type | value range: "DPT 5.001 | 0 ... 100%", "DPT 5.010 | 0 ... 255", "DPT 5.003 | 0 ... 360°", "DPT 5.004 | 0 ... 255%", "DPT 6.010 | -128 ... 127", "DPT 7.001 | 0 ... 65535", "DPT 7.600 | 1000 ... 10000 K", "DPT 8.001 | -32768 ... 32767", "DPT 9.001 | 0 ... 40 °C", "DPT 9.004 | 0 ... 1500 lux"	

Start value	**Same as configured value** Same as value after last adjustment As value from status object colour angle (H) As value from status object brightness (V) As value from status object RGB

Value adjustment can begin with different starting values.

With "Same as configured value": After each press, the device always starts with the value configured in the ETS.

With "Same as value after last adjustment": After a press, the device starts with the value transmitted by itself or by another device with this group address as the last value.

With "same as value from status object colour angle (H)": the device starts when operated with the value from the object "Value transmitter – Colour angle (H) – Status". Available only with the data point type | value range: "RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)"

With "same as value from status object brightness (V)": the device starts when operated with the value from the object "Value transmitter – Brightness (V) – Status". Available only with the data point type | value range: "RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)"

With "same as value from status object RGB": the device starts when operated with the value from the object "Value transmitter – RGB – Status".

These parameters are only visible if "value adjustment = active"!

The start value of the value adjustment is different for both buttons of a rocker if the setting is "Same as value after last adjustment". If the value adjustment works for both push-buttons of a rocker and therefore the last rocker adjustment is to be taken into account, the setting "same as value from status object..." must be configured.

This selection is available only with the data point type | value range: "RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)", "RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".

Direction	Upwards Downwards **Toggling (alternating)**

When operated, the device can either adjust the values always in the same direction or store the direction of the last adjustment and reverse it the next time the button is pressed.

This parameter is visible only if "value adjustment = active"!

This selection is available only with the data point type | value range: "DPT 5.001 | 0 ... 100%", "DPT 5.010 | 0 ... 255", "DPT 5.003 | 0 ... 360°", "DPT 5.004 | 0 ... 255%", "DPT 6.010 | -128 ... 127", "DPT 7.001 | 0 ... 65535", "DPT 7.600 | 1000 ... 10000 K", "DPT 8.001 | -32768 ... 32767", "DPT 9.001 | 0 ... 40 °C", "DPT 9.004 | 0 ... 1500 lux"

Direction	**Colour sequence in clockwise direction (red -> green -> blue -> red -> ...)** Colour sequence in anti-clockwise direction (red -> blue -> green -> red -> ...) Toggling colour sequence (alternating with each new rising edge)
When operated, the device can either adjust the values always in the same direction or store the direction of the last adjustment and reverse it the next time the button is pressed. This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".	

Direction	**Brighter** Darker Toggling (alternating)
When operated, the device can either adjust the values always in the same direction or store the direction of the last adjustment and reverse it the next time the button is pressed. This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".	

Increment	1...**15**
In a value adjustment, the device determines the new telegram value from the previous value and the preset step width. If the value falls below the lower limit of the adjustment range or if it exceeds the upper limit, the sensor adapts the step width of the last step automatically. This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "DPT 5.001 | 0 ... 100%", "DPT 5.010 | 0 ... 255", "DPT 5.003 | 0 ... 360°", "DPT 5.004 | 0 ... 255%", "DPT 6.010 | -128 ... 127", "RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".	

Increment	1, 2, 5, 10, 20, 50, 75, **100**, 200, 500, 750, 1000
In a value adjustment, the device determines the new telegram value from the previous value and the preset step width. If the value falls below the lower limit of the adjustment range or if it exceeds the upper limit, the sensor adapts the step width of the last step automatically. This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "DPT 7.001 | 0 ... 65535", "DPT 8.001 | -32768 ... 32767".	

Increment	0.5, **1** ... 40
This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "DPT 9.001 | 0 ... 40°C".	

Increment	1, 10, 20 ... **500** ... 1000
This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "DPT 7.600 | 1000 ... 10000 K".	

Increment	1 ... **50** ... 1500 lux
This parameter is visible only if "value adjustment = active"! This value range is only available for the following functions: 2-byte brightness value.	

Increment	**1**, 2, 4, 5, 10, 20, 25, 30, 50, 60
In a value adjustment, the device determines the new telegram value from the previous value and the preset step width. If the value falls below the lower limit of the adjustment range or if it exceeds the upper limit, the sensor adapts the step width of the last step automatically. This parameter is visible only if "value adjustment = active"! This selection is available only with the data point type | value range: "RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".	

Minimum limit value	**0** ... 100%
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".	

Minimum limit value	**0** ... 255
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 5.010 | 0 ... 255".	

Minimum limit value	**0** ... 360°
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 5.003 | 0 ... 360°".	

Minimum limit value	**0** ... 255%
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 5.004 | 0 ... 255%".	

Minimum limit value	-128...**0** ...127
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 6.010 | -128 ... 127".	

Minimum limit value	**0** ... 65535
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 7.001 | 0 ... 65535".	

Minimum limit value	1000 ... **2700** ... 10000 K
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 7.600 | 1000 ... 10000 K".	

Minimum limit value	-32768 ... **0** ... 32767
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 8.001 | -32768 ... 32767".	

Minimum limit value	0 ... **20** ... 40 °C
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 9.001 | 0 ... 40°C".	

Minimum limit value	0, 50 ... **300** ... 1500 lux
This parameter determines a lowest value that is not undershot during a value adjustment. It is visible only if "data point type | value range = DPT 9.004 | 0 ... 1500 lux".	

Maximum limit value	**0** ... 100%
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".	

Maximum limit value	**0** ... 255
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 5.010 | 0 ... 255".	

Maximum limit value	**0** ... 360°
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 5.003 | 0 ... 360°".	

Maximum limit value	**0** ... 255%
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 5.004 | 0 ... 255%".	

Maximum limit value	-128...**0** ...127
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 6.010 | -128 ... 127".	

Maximum limit value	**0** ... 65535
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 7.001 | 0 ... 65535".	

Maximum limit value	1000 ... **2700** ... 10000 K
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 7.600 | 1000 ... 10000 K".	

Maximum limit value	-32768 ... **0** ... 32767
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 8.001 | -32768 ... 32767".	

Maximum limit value	0 ... **20** ... 40 °C
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 9.001 | 0 ... 40°C".	

Maximum limit value	0, 50 ... **300** ... 1500 lux
This parameter determines the highest value that is not exceeded during a value adjustment. It is visible only if "data point type | value range = DPT 9.004 | 0 ... 1500 lux".	

Value adjustment starts after	0 s after pressing the button 0.5 s after pressing the button 1 s after pressing the button 2 s after pressing the button 3 s after pressing the button **5 s** after pressing the button
This parameter determines the time from when the device starts the value adjustment after a key is pressed. This parameter is visible only if "value adjustment = active"!	

Time between two telegrams	0 s **0.5 s** 1 s 2 s 3 s
This parameter defines the interval at which the device transmits new telegrams during a value adjustment. i With the setting "0 s", a telegram is only sent when actuation begins. This parameter is visible only if "value adjustment = active"!	

Value adjustment with overflow	Active **Inactive**
If value adjustment is to be effected without overflow (setting "inactive") and if the device reaches the lower limit of the adjustment range or the upper limit during value adjustment, the adjustment will be stopped automatically by the sensor. If the value adjustment with overflow is programmed (setting "active") and if the device reaches the lower or the upper limit, it will transmit the value of this range limit and then add a pause the duration of which corresponds to two levels. Thereafter, the device transmits a telegram with the value of the other range limit and continues the value adjustment in the same direction. i This parameter cannot be parameterised and is written to "0" if Direction = toggle (alternating)" and "Time between two telegrams = 0 s" is set.	

10.6.2 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Value transmitter - 0...100%	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object for the transmission of values from 0 to 100%. These objects are visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...255	Button/rocker *n* - output	1-byte	5,010	C, R, -, T, A
1-byte object for the transmission of values from 0 to 255. These objects are visible only if "data point type | value range = DPT 5.010 | 0 ... 255".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...360°	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A
1-byte object for the transmission of values from 0 to 360°. These objects are visible only if "data point type | value range = DPT 5.003 | 0 ... 360°".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...255%	Button/rocker *n* - output	1-byte	5,004	C, R, -, T, A
1-byte object for the transmission of values from 0 to 255%. These objects are visible only if "data point type | value range = DPT 5.004 | 0 ... 255%".				

Function	Name	Type	DPT	Flag
Value transmitter -128...127	Button/rocker *n* - output	1-byte	6,010	C, R, -, T, A
1-byte object for the transmission of values from -128 to 127. These objects are visible only if "data point type | value range = DPT 6.010 | -128 ... 127".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...65535	Button/rocker *n* - output	2-byte	7,001	C, R, -, T, A
2-byte object for the transmission of values from 0 to 65535. These objects are visible only if "data point type | value range = DPT 7.001 | 0 ... 65535".				

Function	Name	Type	DPT	Flag
Value transmitter - Colour temperature value	Button/rocker *n* - output	2-byte	7,600	C, R, -, T, A
2-byte object for transmitting colour temperatures from 1000 to 10000 Kelvin. These objects are visible only if "data point type | value range = DPT 7.600 | 1000 ... 10000 K".				

Function	Name	Type	DPT	Flag
Value transmitter -32768...32767	Button/rocker *n* - output	2-byte	8,001	C, R, -, T, A
2-byte object for the transmission of values from -32768 to 32767. These objects are visible only if "data point type | value range = DPT 8.001 | -32768 ... 32767".				

Function	Name	Type	DPT	Flag
Value transmitter - Temperature value	Button/rocker *n* - output	2-byte	9,001	C, R, -, T, A
2-byte object for transmitting temperature values from 0 to 40 °C. These objects are visible only if "data point type | value range = DPT 9.001 | 0 ... 40°C".				

Function	Name	Type	DPT	Flag
Value transmitter - Brightness value	Button/rocker *n* - output	2-byte	9,004	C, R, -, T, A
2-byte object for transmitting brightness values from 0 to 1500 Lux. These objects are visible only if "data point type | value range = DPT 9.004 | 0 ... 1500 lux".				

Function	Name	Type	DPT	Flag
Value transmitter - RGB/HSV (colour wheel sequence)	Button/rocker *n* - output	3-byte	232,600	C, R, -, T, A
3-byte object for transmitting 3-byte colour information. These objects are visible only if "data point type | value range = RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".				

Function	Name	Type	DPT	Flag
Value transmitter - Colour hue (H)	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A

1-byte object for transmitting the colour hue.

These objects are visible only with data point type | value range:

- - RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - Colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)

Function	Name	Type	DPT	Flag
Value transmitter - Saturation (S)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A

1-byte object for transmitting the saturation.

These objects are visible only with data point type | value range:

- - RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - Colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)

Function	Name	Type	DPT	Flag
Value transmitter - brightness value (V)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A

1-byte object for transmitting the brightness value.

These objects are visible only with data point type | value range:

- - RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- - Colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)

Function	Name	Type	DPT	Flag
Value transmitter - White value (W)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A

1-byte object for transmitting the white level.

These objects are visible only with data point type | value range: colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001).

Function	Name	Type	DPT	Flag
Value transmitter - RGB/HSV (brightness adjustment)	Button/rocker *n* - output	3-byte	232,600	C, R, -, T, A

3-byte object for transmitting 3-byte colour information.

These objects are visible only with data point type | value range: RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001).

Function	Name	Type	DPT	Flag
Value transmitter - RGBW	Button/rocker *n* - output	6-byte	251,600	C, R, -, T, A

6-byte object for transmitting 6-byte colour information.

These objects are visible only with data point type | value range: colour value RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001).

Function	Name	Type	DPT	Flag
Value transmitter - Brightness value (V) status	Button/rocker *n* - input	1-byte	5,001	C, -, W, -, U

1-byte object for receiving the brightness value.

These objects are only visible with the following configuration:

– - Data point type | value range: RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)

– - "Starting value" parameter = same as value from feedback object (1-byte brightness/V value)

Function	Name	Type	DPT	Flag
Value transmitter - Colour hue (H) status	Button/rocker *n* - input	1-byte	5,003	C, -, W, -, U

1-byte object for receiving the colour hue.

These objects are only visible with the following configuration:

– - Data point type | value range: RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)

– - "Starting value" parameter = same as value from feedback object (1-byte/ colour hue/H value)

Function	Name	Type	DPT	Flag
Value transmitter - RGB - Status	Button/rocker *n* - input	3-byte	232,600	C, -, W, -, U
3-byte object for receiving 3-byte colour information. These objects are only visible with the following configuration: – - Parameter: data point type | value range: RGB/HSV with brightness adjustment (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001), RGB/HSV with colour wheel sequence (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001). – - "Starting value" parameter = same as value from feedback object (3-byte RGB)				

10.7 Scene extension

For each rocker or button whose function is set to "scene extension", the ETS shows the command "short button actuation" and "long button actuation".

In the scene extension function, the device sends a preset scene number (1…64) via the "scene extension" communication object to the bus after pressing the button briefly. This makes it possible to recall scenes stored in other devices.

Setting options when button is pressed briefly:

- Recall scene: results in simply recalling the scene.
- Switch over scene: The input option for a second scene number (1…64) appears. The two entered scene numbers are switched to and from each time the button is briefly pressed.

Setting options when button is pressed and held:

- No reaction
- Storage function: A storage command is generated by a button actuation for more than five seconds. In the scene extension function, a storage telegram is in this case transmitted to the bus. The internal scene is stored. The internal scene control module will then request the current scene values for the actuator groups used from the bus.

i A button actuation lasting between one and five seconds will be discarded as invalid.

10.7.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Short button operation	**Recall scene** Switch over scene
This parameter defines the functionality of the scene extension. If the device is used as a scene extension, the scenes can either be stored in one or several other KNX devices (e.g. light scene push button sensor). When a scene is recalled, the device transmits a telegram with the respective scene number via the extension object of the button.	

Scene number	**1**...64
In accordance with the KNX standard, objects with data type 18.001 "Scene Control" can retrieve or store up to 64 scenes by their numbers. The parameter defines the scene number to be transmitted when the button is pressed.	

First scene number	**1**...64
In accordance with the KNX standard, objects with data type 18.001 "Scene Control" can retrieve or store up to 64 scenes by their numbers. The parameter defines the scene number to be transmitted when the button is pressed. The input of the first scene number is available only if "Switch over scene" is active in the event of the "short button actuation" command.	

Second scene number	1, **2** ... 64
In accordance with the KNX standard, objects with data type 18.001 "Scene Control" can retrieve or store up to 64 scenes by their numbers. The parameter defines the scene number to be transmitted when the button is pressed. The input of the second scene number is available only if "Switch over scene" is active in the event of the "short button actuation" command.	

Long button operation	**No reaction** Memory function
This parameter defines the functionality of the scene extension. If the device is used as a scene extension, the scenes can either be stored in one or several other KNX devices (e.g. light scene push button sensor). With activated storage function, the device transmits a telegram with the respective scene number via the extension object of the button.	

10.7.2 Object list

Function	Name	Type	DPT	Flag
Scene extension - Scene number	Button/rocker *n* - output	1-byte	18,001	C, R, -, T, A
1-byte object for recalling or for storing one of 64 scenes max. from a scene push-button sensor.				

10.8 Short and long button operation

The "short and long button actuation" function allows two objects to be operated with one button. In some situations it is desirable to control two different functions with a single press of a button and to transmit different telegrams.

For both objects, the "short button actuation (object 1)" and "long button actuation (object 2)" function can be used to determine the communication object types to be used.

The following functions are available:

- DPT 1.001 | Switching
- DPT 5.001 | 0 ... 100%
- DPT 5.010 | 0 ... 255
- DPT 5.003 | 0 ... 360°
- DPT 5.004 | 0 ... 255%
- DPT 6.010 | -128 ... 127
- DPT 7.001 | 0 ... 65535
- DPT 8.001 | -32768 ... 32767
- DPT 9.001 | 0 ... 40 °C
- DPT 9.004 | 0 ... 1500 lux
- DPT 18.001 | Call up scene (externally)
- RGB/HSV (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)
- RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)

The object value that the device is to transmit on a button actuation can be selected depending on the selected function.

"DPT 1.001 | switching" can be used to select whether an ON or OFF telegram is to be sent or the object value is to be switched over (TOGGLE) and sent when the button is pressed.

With configuration as value transmitter ("DPT 5.001 | 0 ... 100% ..." or "DPT 7.001 | 0 ... 65535 ...") the object value can be selected within the value range.

"DPT 18.001 | Recall scene (externally)" can be used to set the scene number to be transmitted to the bus when the button is pressed.

The status LEDs can be configured independently.

Unlike in the other rocker and button functions, the application program assigns the "Telegram acknowledge" function instead of the "Actuation display" function to the status LED. In this mode, the status LED lights up for approx. 250 ms with each telegram transmitted.

Transmission behaviour, long button actuation = object 2

With this transmission behaviour, exactly one telegram is sent each time the button is pressed.

- The device sends the telegram for object 1 if the button is pressed briefly.
- The device sends the telegram for object 2 if the button is pressed longer.

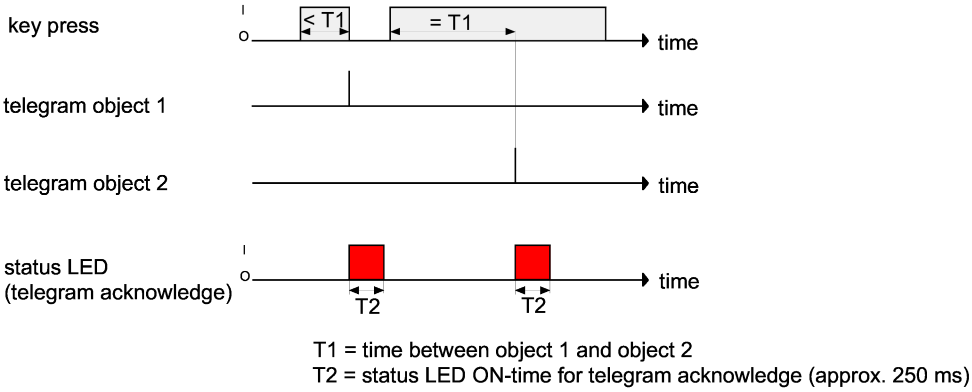

Figure 41: Example of "object 1 or object 2" operating concept

The "Long button actuation from" parameter defines the time period for distinguishing between short-time and long-time operation. If the button is pressed for shorter than the configured time, only the telegram to object 1 is sent. If the time for long button actuation is exceeded by the actuation period, only the telegram to object 2 will be sent. This concept provides the transmission of only one object. To indicate that a telegram has been transmitted, the status LED lights up for approx. 250 ms in the "Telegram acknowledge" setting.
In this operating concept, the push-button sensor will not transmit a telegram immediately after the rocker has been depressed.

Transmission behaviour, long button actuation = object 1 and object 2

With this transmission behaviour, one or alternatively two telegrams can be transmitted each time the button is pressed.

- The device will send the telegram for object 1 if the button is pressed briefly.
- The device will send the telegram for object 1 and then the telegram for object 2 if the button is pressed longer.

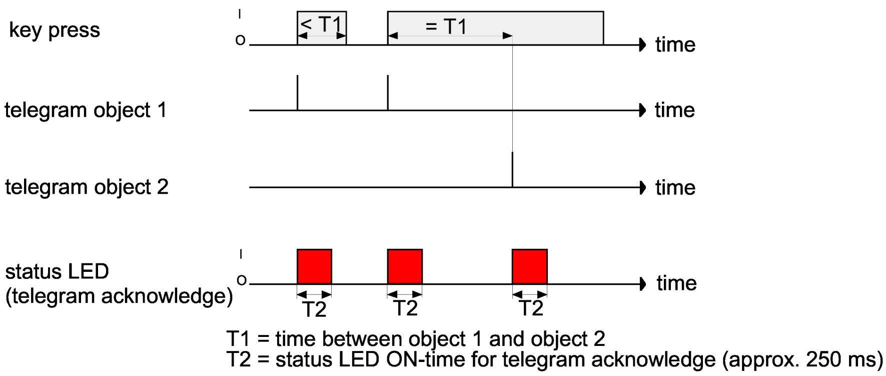

Figure 42: Example of "object 1 and object 2" operating concept

The "Long button actuation from" parameter defines the time period for distinguishing between short-time and long-time operation. The telegram to object 1 is immediately sent if the button is pressed. If the button is held depressed for the configured time, the telegram for object 2 is transmitted as well. If the button is released before the time has elapsed, no further telegram will be transmitted. This operating concept, too, offers the configurable possibility of having the transmission of a telegram signalled by the status LED (setting "Telegram acknowledge").

Full-surface operation with the "short and long button actuation" function

If a rocker is configured for "short and long button actuation", the device needs some time at the beginning of each operation to distinguish between short and long operation. When full-surface operation is enabled, the device can make use of this time span to evaluate the otherwise invalid simultaneous actuation of both buttons of a rocker.

Full-surface operation of a rocker is detected by the device when both buttons are pressed at the same time. When the device has detected a valid full-surface operation, the status LED flashes quickly at a rate of about 8 Hz for the duration of the actuation. The full-surface operation needs to have been detected before the first telegram is sent. If this is not so (e.g. one of the two buttons is pressed too late), the full-surface operation will not be correctly executed.

10.8.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Short button actuation (object 1)	No function **DPT 1.001 | Switching** DPT 5.001 | 0 ... 100% DPT 5.010 | 0 ... 255 DPT 5.003 | 0 ... 360° DPT 5.004 | 0 ... 255% DPT 6.010 | -128 ... 127 DPT 7.001 | 0 ... 65535 DPT 8.001 | -32768 ... 32767 DPT 9.001 | 0 ... 40 °C DPT 9.004 | 0 ... 1500 lux DPT 18.001 | Call up scene (externally) RGB/HSV (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001) RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)
This parameter determines the function of the short button actuation and defines the other parameters and communication objects to be displayed.	

Long button actuation (object 2)	No function **DPT 1.001 | Switching** DPT 5.001 | 0 ... 100% DPT 5.010 | 0 ... 255 DPT 5.003 | 0 ... 360° DPT 5.004 | 0 ... 255% DPT 6.010 | -128 ... 127 DPT 7.001 | 0 ... 65535 DPT 8.001 | -32768 ... 32767 DPT 9.001 | 0 ... 40 °C DPT 9.004 | 0 ... 1500 lux DPT 18.001 | Call up scene (externally) RGB/HSV (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001) RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)
This parameter determines the function of the long button actuation and defines the other parameters and communication objects to be displayed.	

Short button actuation (object 1) Long button actuation (object 2)	ON OFF **TOGGLE**
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 1.001 | switching".	

Value	**0**...100
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 5.001 | 0 ... 100%".	

Value	**0**...255
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 5.010 | 0 ... 255".	

Value	**0**...360
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 5.003 | 0 ... 360°".	

Value	0...255
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 5.004 | 0 ... 255%".	

Value	-128...0...127
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 6.010 | -128 ... 127".	

Value	0...65535
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 7.001 | 0 ... 65535".	

Value	-32768...0...32767
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 8.001 | -32768 ... 32767".	

Temperature value	0...20...40
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 9.001 | 0 ... 40°C".	

Brightness value	0...300...1500
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function of object 1 (2) = DPT 9.004 | 0 ... 1500 lux".	

Scene number	1...64
This parameter defines the object value transmitted to the bus when the button is pressed. It is visible only if "function = DPT 18.001 | Recall scene (externally)".	

Colour value	#000000 ... #FFFFFF
This parameter determines the object values of the colour hue (H), saturation (S), brightness value (V), which is transmitted to the bus when the button is pressed. It is visible if "function = RGB/HSV (RGB: DPT 232.600, HSV: DPT 5.003, DPT 5.001, DPT 5.001)".	

White value	0 ... 255
This parameter defines the object value of the white level (W) object when the button is pressed. It is visible only if "function = RGBW/HSVW (RGBW: DPT 251.600, HSVW: DPT 5.003, DPT 5.001, DPT 5.001, DPT 5.001)".	

Long button operation from	0...3...25 s | 0...990 ms
This parameter defines the interval at which the device transmits the telegram for object 1 and the telegram for object 2, depending on the selected transmission behaviour. A time from 100 ms to 25.5 s can be set.	

Full-surface operation	Active Inactive
When the full-surface operation is activated, the ETS shows the following parameters. Full-surface operation can be configured only if "operating concept = rocker function"!	

Function	Switching Scene extension
In case of full-surface operation, this parameter defines the function that is to be used. The ETS shows the corresponding communication object and the other parameters. This parameter is only visible if "Full-surface actuation = Active"!	

Command	ON OFF TOGGLE
This parameter defines the value of the transmitted telegram when a full-surface operation has been sensed. "TOGGLE" changes over the current object value. This parameter is visible only if "function = switching"!	

Short button operation	Recall scene Switch over scene
This parameter defines the functionality of the scene extension. If the device is used as a scene extension, the scenes can either be stored in one or several other KNX devices (e.g. light scene push button sensor). When a scene is recalled, the device transmits a telegram with the respective scene number via the extension object of the button. This parameter is visible only if "function = scene extension"!	

Scene number (1 … 64)	1 ... 64
This parameter defines the scene number, which is to be transmitted to the bus after a scene recall or during storage of a scene. This parameter is only visible with "Function in the event of full-surface operation = Recall scene"!	

First scene number (1 … 64)	1 ... 64
This parameter defines the scene number, which is to be transmitted to the bus after a scene recall or during storage of a scene. This parameter is only visible if "function for full-surface operation = scene recall ..."! The input of the first scene number is available only if "Switch over scenes" is active in the event of the "short button actuation" command.	

Second scene number (1 … 64)	1, 2 ... 64
This parameter defines the scene number, which is to be transmitted to the bus after a scene recall or during storage of a scene. This parameter is only visible if "function for full-surface operation = scene recall ..."! The input of the second scene number is available only if "Switch over scenes" is active in the event of the "short button actuation" command.	

Long button operation	No reaction Memory function
It can be set here whether the scene is to be stored when a button is pressed and held. This parameter is visible only if "function = scene extension"!	

10.8.2 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Switching	Button/rocker *n* - output	1-bit	1,001	C, R, -, T, A
1-bit object to send switching telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Switching	Button/rocker *n* - output	1-bit	1,001	C, R, -, T, A
1-bit object to send switching telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...100%	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...100%	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...255	Button/rocker *n* - output	1-byte	5,010	C, R, -, T, A
1-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...255	Button/rocker *n* - output	1-byte	5,010	C, R, -, T, A
1-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...360°	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A
1-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...360°	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A
1-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...255%	Button/rocker *n* - output	1-byte	5,004	C, R, -, T, A
1-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...255%	Button/rocker *n* - output	1-byte	5,004	C, R, -, T, A
1-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value -128...127	Button/rocker *n* - output	1-byte	6,010	C, R, -, T, A
1-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value -128...127	Button/rocker *n* - output	1-byte	6,010	C, R, -, T, A
1-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...65535	Button/rocker *n* - output	2-byte	7,001	C, R, -, T, A
2-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...65535	Button/rocker *n* - output	2-byte	7,001	C, R, -, T, A
2-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value -32768...32767	Button/rocker *n* - output	2-byte	8,001	C, R, -, T, A
2-byte object to send value telegrams if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value -32768...32767	Button/rocker *n* - output	2-byte	8,001	C, R, -, T, A
2-byte object to send value telegrams if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Temperature value	Button/rocker *n* - output	2-byte	9,001	C, R, -, T, A
2-byte object to send temperature values if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Temperature value	Button/rocker *n* - output	2-byte	9,001	C, R, -, T, A
2-byte object to send temperature values if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Brightness value	Button/rocker *n* - output	2-byte	9,004	C, R, -, T, A
2-byte object to transmit brightness values if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Brightness value	Button/rocker *n* - output	2-byte	9,004	C, R, -, T, A
2-byte object to send brightness values if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Scene number 1...64	Button/rocker *n* - output	1-byte	18,001	C, R, -, T, A
1-byte object to send scene values if the button is briefly pressed (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Scene number 1...64	Button/rocker *n* - output	1-byte	18,001	C, R, -, T, A
1-byte object to send scene values if the button is pressed and held (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Colour value (RGB)	Button/rocker *n* - output	3-byte	232,600	C, R, -, T, A
3-byte object to send RBG values if the button is briefly pressed (object 1). This object is visible only if "colour control = combi object: RGB or combi object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Colour value (RGB)	Button/rocker *n* - output	3-byte	232,600	C, R, -, T, A
3-byte object to send RBG values if the button is pressed and held (object 2). This object is visible only if "colour control = combi object: RGB or combi object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Colour value (RGBW)	Button/rocker *n* - output	6-byte	251,600	C, R, -, T, A
6-byte object to send RBGW values if the button is briefly pressed (object 1). This object is visible only if "colour control = combi object: RGB or combi object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Colour value (RGBW)	Button/rocker *n* - output	6-byte	251,600	C, R, -, T, A
6-byte object to send RBGW values if the button is pressed and held (object 2). This object is visible only if "colour control = combi object: RGB or combi object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Red colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the red colour value if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Red colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the red colour value if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Green colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the green colour value if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Green colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the green colour value if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Blue colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the blue colour value if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Blue colour value	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the blue colour value if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: RGB or individual object: RGBW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Colour hue (H)	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A
1-byte object to send the colour hue if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Colour hue (H)	Button/rocker *n* - output	1-byte	5,003	C, R, -, T, A
1-byte object to send the colour hue if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Saturation (S)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the saturation if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Saturation (S)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the saturation if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Brightness value (V)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the brightness value if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Brightness value (V)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the brightness value if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: HSV or individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - White value (W)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the white value if the button is briefly pressed (object 1). This object is visible only if "colour control = individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - White value (W)	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object to send the white value if the button is pressed and held (object 2). This object is visible only if "colour control = individual object: HSVW" was selected.				

Function	Name	Type	DPT	Flag
Switching	Button/rocker *n* - Full-surface operation - Output	1-bit	1,001	C, R, -, T, A
1-bit object for the transmission of switching telegrams (ON, OFF) when there is full-surface operation.				

Function	Name	Type	DPT	Flag
Switching status	Button/rocker *n* - Full-surface operation - Input	1-bit	1,001	C, R, -, T, A
1-bit object for receiving feedback telegrams (ON, OFF) for full-surface operation.				

Function	Name	Type	DPT	Flag
Scene extension	Button/rocker *n* - Full-surface operation - Output	1-byte	18,001	C, R, -, T, A
1-byte object for recalling or for storing one of 64 scenes max. from a scene push-button sensor in case of full-surface operation.				

10.9 Room temperature control point

The "room temperature control point" button or rocker function can be used to control a KNX room temperature controller.

The room temperature control point itself is not involved in the temperature control process. With it, the user can operate the single-room regulation from different places in the room. The room temperature control point can also be used to control central heating control devices located, for example, in a sub-distribution unit.

Typical KNX room temperature controllers generally offer different ways of influencing the room temperature control:

– Operating mode switchover:
  Switching over between different modes of operation (e.g. "Comfort", "Night" ...) with different setpoint temperatures assigned to each mode by the controller.
– Presence function:
  Signalling the presence of a person in a room. The signalling may also be combined with a configured switchover in the mode of operation.
– Setpoint temperature shift:
  Adjustment of the setpoint temperature via a relative temperature value (DPT 9.002), absolute temperature value (DPT 9.001) or via count value (DPT 6.010).
– Auto/manual fan control:
  Automatic mode activation, manual control activation or auto/manual switchover.
– Manual fan preset:
  Fan level specification in data point type | value range "DPT 5.001 | 0 ... 100%" or "DPT 5.100 | 0 ... 255". The value adjustment can optionally be configured by long pressing of the button.

The room temperature control point is operated with the button functions of the device. In this way, it is possible to completely control a room temperature controller by changing the operating mode, specifying the presence function or adjusting the target temperature shift, by specifying the fan control (auto or manual) or the manual specification of the fan level.

In addition, the device can – also independently of the room temperature control point function – indicate the state of one or more room temperature controllers with the status LEDs of the rockers or buttons. This feature permits the indication of operating modes or the bit-oriented evaluation of different status objects of controllers. In case of the room temperature control point function "Target temperature shift" or "Presence function", the status LEDs can also signal the state of the corresponding functions directly.

10.9.1 Operating mode switchover

Switchover of the controller operating mode can be effected in accordance with the standard function block for room temperature controllers defined in the KNX handbook using two 1-byte communication objects. The operating mode can be switched over with the normal and with the forced objects. The "Operating mode switchover" object offers a selection between the following modes:

- Comfort
- Standby
- Night
- Frost/heat protection
- Switchover: comfort/standby
- Switchover: comfort/night
- Switchover: standby/night
- Switchover: comfort/standby/night

The "Forced operating mode switchover" communication object is of higher priority. It permits forced switching between the following modes of operation:

- Auto (normal operating mode switchover)
- Comfort
- Standby
- Night
- Frost/heat protection
- Switchover: comfort/standby
- Switchover: comfort/night
- Switchover: standby/night
- Switchover: comfort/standby/night
- Switchover: auto/comfort
- Switchover: auto/standby
- Switchover: auto/night
- Switchover: auto / frost/heat protection

The operating mode transmitted to the bus when pressing the button of the room temperature control point is defined by the parameter "When pressed". Depending on the parameterised operating concept, either pressing a button activates one of the above modes (with the "rocker function" and "button function" operating concepts), or each button actuation toggles between two or three modes (only with the "rocker function" operating concept).

If a status LED is to indicate the current operating mode, the status LED function must be programmed for "Operating mode indication" and its status object be linked with the corresponding group address for operating mode change-over with normal or high priority.

10.9.2 Presence function

All operating areas whose function is set to "Presence function" have the two communication objects "Presence" and "Presence - Status". The "When pressed" parameter determines the object value transmitted to the bus in the event of button actuation.

The status LED of a presence function button can directly indicate the presence status (setting "Presence status indicator").

10.9.3 Setpoint temperature shift

Another function of the room temperature control point that is available is the target temperature shift. It makes use of either two 2-byte communication objects with datapoint type 9.002 (relative temperature value) or with datapoint 9.001 (absolute temperature value) or two 1-byte communication objects with datapoint type 6.010 (integer with sign).

This control point function allows the basic setpoint for the temperature to be shifted on a room temperature controller by pressing a button. The control point is usually operated in the same way as the main control point. A button configured as target temperature shift reduces or increases the target temperature shift value each time the button is pressed. The direction of the value adjustment is defined by the parameters "Increase setpoint temperature difference when pressed" or "Reduce setpoint temperature difference when pressed".

The adjustment range of the setpoint temperature shift can be restricted by setting the minimum and maximum limit values.

The status LED of a button that performs a target temperature shift can directly display the status of the target temperature shift ("Setpoint value shift indicator" setting).

Communication with main controller

To enable the device to shift the target temperature on a room temperature controller, the controller must have input and output objects for the target temperature shift. In this case, the output object of the controller must be connected to the input object of the room temperature control point, and the input object of the controller must be connected to the output object of the room temperature control point in each case via their own group address.

All objects are of the same datapoint type and have the same value range. A target temperature shift is interpreted by count values: a shift in positive direction is expressed by positive values, whereas a shift in negative direction is represented by negative object values. An object value of "0" means that no target temperature shift has been set.

The room temperature control points detect the current position of the setpoint adjustment by means of the object "RTC control point - Target temperature shift - Status" of the room temperature control point connected to the room temperature controller. Starting from the value of the communication object, the setpoint is adjusted in the configured direction each time a button is pressed on a room temperature control point. Each time the setpoint is adjusted, the new shift by means of the object "RTC control point - Target temperature shift" of the room temperature control point is sent to the room temperature regulator.

With an "Over counter value" setpoint temperature shift, the individual levels are weighted by the controller itself.

This requires that the respective communication objects are connected to all room temperature control points and the controller. The feedback information from the controller enables the room temperature control point to continue the adjustment at any time at the right point.

10.9.4 Auto/manual fan control

The fan control of a room temperature controller distinguishes between automatic and manual operation. Switching over between the two operating modes can be done using the room temperature controller control point by the 1-bit object "Fan control, auto/manual".

The "Fan control, auto/manual" communication object of the room temperature controller control point has the following object polarity:

– "0" = Automatic mode activation
– "1" = Activation of manual control

10.9.5 Manual fan preset

The room temperature controller control point in the "Manual fan setting" function can specify values for a room temperature controller from 0 ... 100% or 0 ... 255 via the communication object "value transmitter - 0..." . The fan level of a room temperature controller can be specified via this.

The device sends configured values on the bus at the press of a button. In case of a rocker function, different values can be configured for both buttons.

Value ranges

The manual fan setting knows 2 different value ranges. The parameter "Data point type | Value range" determines the value range used by the value transmitter, depending on the application case:

Datapoint type	Value range	Minimum limit value	Maximum limit value
DPT 5.001	0...100%	0%	100%
DPT 5.100	0...255	0	255

For each of these ranges, the value that can be transmitted to the bus for each button actuation is configurable.

Value adjustment

If the value adjustment feature is activated in the ETS, the button for adjusting the value must be kept depressed longer than the configured time period after pressing the button until the start of the adjustment in order to vary the current value of the value transmitter. The value adjustment function continues until the button is released again.

– The value is adjusted across the entire number range.

By activating the "Value adjustment" parameter, further parameters used to configure the value adjustment are displayed in the ETS.

During a value adjustment, the newly adjusted values are only in the volatile RAM memory of the extension module. The stored values are thereby replaced by the preset values programmed in the ETS when a reset of the device occurs (bus voltage failure or ETS programming).

During a value adjustment, a status LED parameterised for the "actuation display" function flashes for each newly sent value if this button is assigned to the status LED for value adjustment.

If "Value adjustment with overflow" is activated, the value adjustment does not stop at the maximum fan level when switching up, but rather starts again at the lowest fan level.

If the starting value of the communication object is used, it may happen in this case during value adjustment that the value last received via the object must be rounded and adapted before a new value can be calculated on the basis of the step width and transmitted. Due to the computation procedure used, the new calculation of the value may be slightly inaccurate.

10.9.6 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

Operating mode switchover

Function	**Operating mode switchover** Forced oper. mode switchover Presence function Setpoint temperature shift Auto/manual fan control Manual fan preset
A room temperature control point can optionally switch over (force) the operating mode with normal or high priority, change the presence status or change the current room temperature setpoint value. It is also possible to specify whether the room temperature controller activates the fan control automatically or manually and a manual fan setting can be made. With regard to the setting of this parameter, the ETS shows further parameters.	

When pressed	**Comfort** Standby Night Frost/heat protection Switchover: comfort/standby Switchover: comfort/night Switchover: standby/night Switchover: comfort/standby/night
If the room temperature control point is intended to change over the operating mode of the room temperature controller with normal priority, the extension can either switch on a defined operating mode or switch between different operating modes when operated.	

Forced operating mode switchover

When pressed	Auto (Normal operating mode switchover) **Comfort** Standby Night Frost/heat protection Switchover: comfort/standby Switchover: comfort/night Switchover: standby/night Switchover: comfort/standby/night Switchover: auto/comfort Switchover: auto/standby Switchover: auto/night Switchover: auto / frost/heat protection
If the room temperature control point is intended to switch the operating mode of the room temperature controller with high priority, the extension can either enable change-over with normal priority (auto), switch on a defined operating mode with high priority or switch different operating modes when operated.	

Presence function

When pressed	Presence ON Presence OFF **Presence TOGGLE**
The room temperature control point can switch the presence state of the room temperature controller either on or off in a defined way or the extension can switch between both states ("Presence TOGGLE") by pressing the button. This parameter is only visible if "Function = presence function".	

Setpoint temperature shift

Setpoint temperature shift	**By relative temperature value (DPT 9.002 | -670760 ... 670760 K)** Via absolute temperature value (DPT 9.001 | 7 ... 45 °C) By counting value (DPT 6.010 | -128 ... 127)
Depending on the setting of the "Target temperature shift" parameter, the shift takes place by means of the 2-byte communication object in accordance with KNX DPT 9.002, 9.001 or KNX DPT 6.010. This parameter is visible only if "function = target temperature shift".	

When pressed	+2 K +1.5 K +1 K **+0.5 K** -0.5 K -1 K -1.5 K -2 K
The temperature difference is defined in Kelvin here by which the setpoint temperature will be shifted up or down when the button is pressed. To shift the target temperature value, the room temperature control point uses the two communication objects "RTC control point - Target temperature shift" and "RTC control point - Target temperature shift - Status". The communication object "RTC control point - Target temperature shift - Status" informs the room temperature control point about the current state of the room temperature controller. Based on this value and the parameter here, the room temperature control point calculates the new level value, which it sends to the room temperature controller via the communication object "RTC control point - Target temperature shift". This parameter is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by relative temperature value" (DPT 9.002 | -670760 ... 670760 K)" or "Setpoint temperature shift = via absolute temperature value (DPT 9.001 | 7 ... 45 °C)".	

Minimum limit value	**-10** ... 10 K
The smallest possible temperature difference for the setpoint, below which the value cannot be adjusted, can be entered here. This parameter is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by relative temperature value" (DPT 9.002 | -670760 ... 670760 K)".	

Minimum limit value	**7** ... 45 °C
The smallest possible temperature difference for the setpoint, below which the value cannot be adjusted, can be entered here. This parameter is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by absolute temperature value" (DPT 9.001 | 7 ... 45 °C)".	

Maximum limit value	-10 ... **10** K
The largest possible temperature difference for the setpoint, beyond which the value cannot be adjusted, can be entered here. This parameter is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by relative temperature value" (DPT 9.002 | -670760 ... 670760 K)".	

Maximum limit value	7 ... **45** °C
The largest possible temperature difference for the setpoint, beyond which the value cannot be adjusted, can be entered here. This parameter is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by absolute temperature value" (DPT 9.001 | 7 ... 45 °C)".	

When pressed	Increase setpoint temperature **Reduce setpoint temperature**
The direction of the target temperature shift is defined here at the room temperature control point. To shift the target temperature value, the room temperature control point uses the two communication objects "RTC control point - Target temperature shift" and "RTC control point - Target temperature shift - Status". The communication object "RTC control point - Target temperature shift - Status" informs the extension about the current state of the room temperature controller. Based on this value and the parameter here, the room temperature control point calculates the new level value, which it sends to the room temperature controller via the communication object "RTC control point - Target temperature shift". This parameter is visible only if "function = target temperature shift" and "type of target temperature shift = above meter value" (DPT 6.010 | -128 ... 127)".	

Minimum limit value	**-4** ... 4
The smallest possible temperature difference for the setpoint, below which the value cannot be adjusted, can be entered here. This parameter is visible only if "function = target temperature shift" and "type of target temperature shift = above meter value" (DPT 6.010 | -128 ... 127)".	

Maximum limit value	-10 ... **10** K
The largest possible temperature difference for the setpoint, beyond which the value cannot be adjusted, can be entered here. This parameter is visible only if "function = target temperature shift" and "type of target temperature shift = above meter value" (DPT 6.010 | -128 ... 127)".	

Auto/manual fan control

When pressed	**Automatic mode activation** Activation of manual control Auto/manual switchover
The fan control of a room temperature controller distinguishes between automatic and manual operation. Switching over between the two operating modes can be done using the room temperature controller control point by the 1-bit object "Fan control, auto/manual". The "Fan control, auto/manual" communication object of the room temperature controller control point has the following object polarity: – "0" = Automatic mode activation – "1" = Activation of manual control This parameter is only visible if "Function = fan control auto/manual".	

Manual fan preset

Data point type | Value range	DPT 5.001 | 0 ... 100% **DPT 5.010 | 0 ... 255**
The "Manual fan setting" function distinguishes between 1-byte values. The following parameters and their settings depend on the setting for this parameter.	

Value when pressed	**0** ... 255
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.010 | 0 ... 255".	

Value when pressed	**0** ... 100%
This parameter defines the object value when the button is pressed. It is visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".	

Value adjustment	**Active** Inactive
If the value adjustment is activated, the ETS shows further parameters. If a status LED is configured for the "actuation display" function and is assigned to the button for value adjustment, then this flashes during a value adjustment. The status LED symbolises that a new telegram has been transmitted.	

Start value	Same as configured value Same as value after last adjustment **Like value from status object**

Value adjustment can begin with different starting values.

With "Same as parameterised value": After each press, the device always starts with the value configured in the ETS.

With "Same as value after last adjustment": After a press, the device starts with the value transmitted by itself or by another device with this group address as the last value.

With "same as value from status object": When the push-button is pressed for a long time, the device starts with the value that it or another device with this group address transmitted as the last value.

This parameter is visible only if "value adjustment = active"!

The start value of the value adjustment is different for both buttons of a rocker if the setting is "Same as value after last adjustment". If the value adjustment works for both buttons of a rocker and the last rocker adjustment is to be taken into account, the setting "Same as value from communication object" must be configured.

Direction	**Upwards** Downwards Toggling (alternating)

When operated, the device can either adjust the values always in the same direction or store the direction of the last adjustment and reverse it the next time the button is pressed.

This parameter is visible only if "value adjustment = active"!

Increment	**1** ... 15

In a value adjustment, the device determines the new telegram value from the previous value and the preset step width. If the value falls below the lower limit of the adjustment range or if it exceeds the upper limit, the sensor adapts the step width of the last step automatically.

The default value depends on the selected data point type. With DPT 5.001, the standard step width is 15.

This parameter is visible only if "value adjustment = active"!

Minimum limit value	**0** ... 255

The smallest possible fan level, below which the value cannot be adjusted, can be entered here.

This parameter is visible only if "value adjustment = active"!

Minimum limit value	0 ... 100%
The smallest possible fan preset, below which the value cannot be adjusted, can be entered here. Applies to DPT 5.001 | 0 ... 100%. This parameter is visible only if "value adjustment = active"!	

Maximum limit value	0 ... 3 ... 255
The largest fan level, beyond which the value cannot be adjusted, can be entered here. This parameter is visible only if "value adjustment = active"!	

Maximum limit value	0 ... 100%
The maximum fan preset, beyond which the value cannot be adjusted, can be entered here. Applies to DPT 5.001 | 0 ... 100%. This parameter is visible only if "value adjustment = active"!	

Value adjustment starts after	0 s after pressing the button 0.5 s after pressing the button 1 s after pressing the button 2 s after pressing the button 3 s after pressing the button 5 s after pressing the button
This parameter determines the time from when the device starts the value adjustment after a key is pressed. This parameter is visible only if "value adjustment = active"!	

Time between two telegrams	0 s 0.5 s 1 s 2 s 3 s
This parameter defines the interval at which the device transmits new telegrams during a value adjustment. This parameter is visible only if "value adjustment = active"!	

Value adjustment with overflow	Active Inactive

If value adjustment is to be effected without overflow (setting "inactive") and if the device reaches the lower limit of the adjustment range or the upper limit during value adjustment, the adjustment will be stopped automatically by the sensor.

If the value adjustment with overflow is programmed (setting "active") and if the device reaches the lower or the upper limit, it will transmit the value of this range limit and then add a pause the duration of which corresponds to two levels. Thereafter, the device transmits a telegram with the value of the other range limit and continues the value adjustment in the same direction.

i This parameter cannot be parameterised and is written to "0" if Direction = toggle (alternating)" and "Time between two telegrams = 0 s" is set.

10.9.7 Object list

The following communication objects are available for the individual buttons or rockers, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be specified by the "Name" parameter.

Function	Name	Type	DPT	Flag
Operating mode	Button/rocker n - output	1-byte	20,102	C, R, -, T, A
1-byte object for switching a room temperature controller between the Comfort, Standby, Night and Frost/heat protection operating modes. This object is only visible if "Function = operating mode switchover".				

Function	Name	Type	DPT	Flag
RTC control point - Operating mode - Status	Button/rocker n - input	1-byte	20,102	C, -, W, -, U
1-byte object for receiving the operating mode of a room temperature controller. This object is only visible if "Function = operating mode switchover".				

Function	Name	Type	DPT	Flag
Forced operating mode	Button/rocker n - output	1-byte	20,102	C, R, -, T, A
1-byte object for switching a room temperature controller under forced control between the Automatic, Comfort, Standby, Night and Frost / heat protection operating modes. This object is only visible if "Function = forced operating mode switchover".				

Function	Name	Type	DPT	Flag
RTC control point - Operating mode - Forced - Status	Button/rocker n - input	1-byte	20,102	C, -, W, -, U
1-byte object for receiving the operating mode of a room temperature controller. This object is only visible if "Function = forced operating mode switchover".				

Function	Name	Type	DPT	Flag
Presence	Button/rocker n - output	1-bit	1,018	C, R, -, T, A
1-bit object for changing over the presence status of a room temperature controller. This object is only visible if "Function = presence function".				

Function	Name	Type	DPT	Flag
RTC control point - Presence - Status	Button/rocker n - input	1-bit	1,018	C, -, W, -, U
1-bit object for receiving the presence status of a room temperature controller. This object is only visible if "Function = presence function".				

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift</td><td>Button/rocker n - output</td><td>2-byte</td><td>9,002</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="5">2-byte object for specification of a relative setpoint temperature shift in Kelvin. The value "0" means that no shift is active . Values can be specified between -670760 K and 670760 K.
This object is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by relative temperature value".</td></tr>
</table>

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift status</td><td>Button/rocker n - input</td><td>2-byte</td><td>9,002</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="5">2-byte object for receiving the status of the current target temperature shift in Kelvin.
This object is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by relative temperature value".</td></tr>
</table>

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift</td><td>Button/rocker n - output</td><td>2-byte</td><td>9,001</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="5">2-byte object for specification of an absolute setpoint temperature shift in degrees Celsius.
This object is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by absolute temperature value".</td></tr>
</table>

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift status</td><td>Button/rocker n - input</td><td>2-byte</td><td>9,001</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="5">2-byte object for receiving the status of the current setpoint temperature shift in degrees Celsius.
This object is visible only if "Functionality = setpoint temperature shift" and "Setpoint temperature shift = by absolute temperature value".</td></tr>
</table>

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift</td><td>Button/rocker n - output</td><td>1-byte</td><td>6,010</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="5">1-byte object for specification of a target temperature shift. The value "0" means that no shift is active . The value is depicted in a two's complement in the positive or negative direction.
This object is visible only if "function = target temperature shift" and "type of target temperature shift = above meter value".</td></tr>
</table>

<table>
<tr><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>Setpoint shift status</td><td>Button/rocker n - input</td><td>1-byte</td><td>6,010</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="5">1-byte object to receive the status of the current target temperature shift.
This object is visible only if "function = target temperature shift" and "type of target temperature shift = above meter value".</td></tr>
</table>

Function	Name	Type	DPT	Flag
RTC control panel - Auto/manual fan control	Button/rocker n - output	1-bit	1,003	C, R, -, T, A
1-byte object for specifying whether the fan control is controlled automatically or manually. This object is only visible if "Function = fan control auto/manual".				

Function	Name	Type	DPT	Flag
RTC control point - Auto/manual fan control - Status	Button/rocker n - input	1-bit	1,003	C, -, W, -, U
1-byte object for receiving the status whether the fan control is controlled automatically or manually. This object is only visible if "Function = fan control auto/manual".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...100%	Button/rocker *n* - output	1-byte	5,001	C, R, -, T, A
1-byte object for the transmission of values from 0 to 100%. These objects are visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...100% - Status	Button/rocker *n* - input	1-byte	5,001	C, -, W, -, U
1-byte object for the reception of values from 0 to 100%. These objects are visible only if "data point type | value range = DPT 5.001 | 0 ... 100%".				

Function	Name	Type	DPT	Flag
Value transmitter - 0...255	Button/rocker *n* - output	1-byte	5,100	C, R, -, T, A
1-byte object for the transmission of values from 0 to 255. These objects are visible only if "data point type | value range = DPT 5.010 | 0 ... 255".				

Function	Name	Type	DPT	Flag
Value status (0…255)	Button/rocker *n* - input	1-byte	5,100	C, -, W, -, U
1-byte object for the transmission of values from 0 to 255. These objects are visible only if "data point type | value range = DPT 5.010 | 0 ... 255".				

10.10 Change in the display reading

Up to 17 pieces of display information (time, actual temperature, setpoint temperature, outdoor temperature, any temperature) can be optionally displayed on the LC display of the device with the room temperature controller icons.

The individual pieces of information are shown separately in the numeric display. If more than one piece of display information is configured in the ETS in the parameter node "Display - General", then the display must be switched over during operation.

In addition to the cyclical change, the indication can also be switched by pressing a button on the device. To do this it is possible to configure a button for the "Change in the display reading" function. This configuration is performed in the parameter block of the respective button. This function can be configured for any desired buttons on the TSM and optionally also for buttons on the extension module.

When a button is pressed, depending on the "When pressed" parameter either the next or the previous display information is called up in accordance with the cyclical change. With this setting the display information specified according to the configuration in the "Display" parameter node can be switched directly.

Alternatively it is also possible to call up a particular piece of information immediately independently of the display information of the cyclical change (e.g. button function "Call up time"). It is not assumed here that the indication called up in this manner is in fact integrated into the cyclical change. After a piece of information is called up by pressing a button, the indication is retained until the time for the cyclical change has elapsed.

In the parameter node "Display -> Display - Module -> Display information n", it is also possible to set that there is no display using the parameter "Display information n". In the "No display" setting, no information is shown in the display when the display information is recalled (by button function, by object or cyclically). The appropriate segments for display information are switched off. In this case, the display is dark when the button function icons are not displayed. It is then only possible as necessary to call up individual display information by pressing a button using the button function "Change in the display reading". The indication called up in this manner then remains temporarily visible in the display depending on the time configured for the cyclical change.

In the "No display" setting, no information is shown in the display when the display information is recalled (by button function, by object or cyclically). The appropriate segments for display information are switched off.

The time for the cyclical change of the display can be set in the ETS in the parameter node "Display".

10.10.1 Table of parameters

The following parameters are available for the individual buttons, depending on the set operating concept. The default settings change in accordance with the set operating concept.

When pressed	No reaction **Scroll to next display function** Scroll to previous display function Call up time Call up actual temperature Call up setpoint temperature Call up outdoor temperature Recall any temperature 1 Call up actual temperature controller 1 Call up setpoint temperature controller 1 Call up outdoor temperature controller 1 Recall any temperature controller 1 Call up actual temperature controller 2 Call up setpoint temperature controller 2 Call up outdoor temperature controller 2 Recall any temperature controller 2
This parameter defines the reaction when the button is pressed. Up to 17 pieces of display information (time, actual temperature, setpoint temperature, outdoor temperature, etc.) can be shown on the LC display of the device. The individual pieces of information are shown separately in the numeric display. In addition to the cyclical change, the indication can also be switched by pressing a button on the device. When a button is pressed, depending on this parameter either the next or the previous display information is called up in accordance with the cyclical change. With this setting the display information specified according to the configuration in the "Display" parameter node can be switched directly. Alternatively it is also possible to call up a particular piece of information immediately independently of the display information of the cyclical change (e.g. button function "Call up time"). It is not assumed here that the indication called up in this manner is in fact integrated into the cyclical change. After a piece of information is called up by pressing a button, the indication is retained until the time for the cyclical change has elapsed.	

10.11 Status LED

Each operating element on the TSM or on the TSEM has a three-colour status LED. The functions available differ slightly depending on the settings of the rockers or buttons.

The configurable functions of the status LED adapt to the configured functions of the rockers or buttons.

Independent functions of the status LED

A variety of functions of the status LED can be configured independently of the configured rocker or button function. These functions either define a fixed lighting status of the status LED or have a separate communication object.

The following functions can always be configured for each Status LED:

- always OFF
- always ON
- 2-colour status indicator (LED object) (only if "colour selection per status LED"!)
- Control via separate LED object
- Operating mode indication
- Controller status indication
- Comparator without sign (1-byte)
- Comparator with sign (1-byte)
- Logic link
- Bit-coded evaluation

Dependent functions of the status LED

A variety of functions of the status LED can be configured depending on the configured rocker or button function.

The following functions are configurable for each Status LED depending on the configured rocker or button function:

- Button-actuation indication
- Telegram acknowledgment
- Status indication
- Inverted status indication
- Presence status indication
- Inverted presence status indication
- Setpoint value shift indication
- Auto/manual fan control status display
- Inverted auto/manual fan control status display

ℹ Besides the functions that can be set separately for each status LED, all status LEDs are also used together for LED alarm signalling. If this is active, all LEDs of the device flash simultaneously. After deactivation of the alarm signalling, all LEDs will immediately return to the state corresponding to their configuration and communication objects.

10.11.1 Basic functions

"always OFF" or "always ON"

The corresponding status LED is always switched off or always switched on depending on the parameter setting.

"Button-actuation indication"

This function can be configured for each status LED if the rocker or button is configured to "switching", "dimming", "venetian blind", "value transmitter", "scene extension" or "room temperature control point":

– With the rocker function, each actuation of one of the two buttons is displayed.
– With the button function, the parameter "Assignment of the status LED" decides whether the actuation of both buttons or a single button is displayed.

A status LED used as button-actuation display is switched on by the device each time the corresponding rocker or button is pressed. The parameter "Light period for button-actuation indicator" on the parameter page "Configuration TSM/TSEM" determines how long the status LED for all status LEDs remains on together. Even if the device only sends a telegram when you release it, the status LED lights up regardless of whether you press the rocker or button.

In the "value transmitter" device function with activated value adjustment, a status LED configured for the "Actuation display" function flashes each time a new value is transmitted.

"Telegram acknowledgment"

This function can be configured for each status LED if the rocker or button is configured to "short and long button actuation":

If a status LED is used for telegram acknowledgement, the status LED lights up when both channels are transmitted for about 250 ms each.

"Status display" and "inverted status display"

These functions can be configured for each status LED if the rocker or button is configured to "switching" or "dimming and colour temperature":

With the rocker or button functions "switching" and "dimming and colour temperature", the status LEDs can also be connected internally to the "switching status" object and therefore signal the current switching state of the actuator group.
It is possible to indicate or evaluate the inverted object value.

After a bus reset or after ETS programming, the value of the LED object is always "OFF".

Function of the status LED "2-colour status display"

The status LEDs can indicate the current switching state of a separate LED communication object for each rocker or button function. A colour can be configured for each switching state of the object. The parameter "colour of status LED" defines the display colour of status LED for the switching states "ON" and "OFF", e.g. "OFF= blue, ON = green".
This requires that the parameter "Colour" on the parameter page "Configuration TSM" is set to "Colour selection per status LED".
After a reset or after ETS programming, the value of the communication object is always "OFF".

"Control via separate LED object"

Each status LED can indicate the state of a separate LED communication object.
Here the LED can be switched on or off statically via the 1-bit object value received, or also activated as flashing. If multiple status LEDs are configured to "flashing" and switched on, they will flash synchronously.
It is possible to indicate or evaluate the inverted object value.

After a bus reset or after ETS programming, the value of the LED object is always "OFF".

"Operating mode indication"

In this configuration the status LED has its own 1-byte communication object.
If a status LED is to indicate the operating mode, the communication object of the status LED must be linked with the matching object of a room temperature controller (e. g. Controller status). The desired operating mode that the LED is to indicate can then be selected with the parameter "Status LED ON with". The LED is then lit up when the corresponding operating mode has been activated at the controller.

After a bus reset or after ETS programming, the value of the LED object is always "0" (automatic).

"Controller status indication"

The status LED indicates the controller status in the "KNX-compliant" data format.
The objects should be connected to the communication objects of the main controller with the same functions via group addresses.
The status objects combine different information. The "Status LED on with" parameter is used to select what information should be evaluated and displayed via the status LED.

The following information is available for selection with "KNX-compliant":

– Controller error status
– Operating mode (Heating = 1 / Cooling = 0)
– Controller disabled (dew point operation)

– Frost alarm ("0" = Frost protection temperature exceeded / "1" = Frost protection temperature undershot)
– Heat alarm ("0" = Heat protection temperature exceeded / "1" = Heat protection temperature undershot)
– Controller inactive (Is active in the "Heating and cooling" operating mode when the measured room temperature lies within the deadband. This status information is as a rule always "0" for the individual operating modes "heating" or "cooling"! Is inactive if controller is disabled.)
– Comfort mode extension ("0" = extension inactive/ "1" = extension active)
– Window open ("0" = Window closed / "1" = Window open)
– Additional level active ("0" = Additional level inactive / "1" = Additional level active)

The following table shows the evaluation of the three KNX-compliant objects.

Status LED ON with	Object RHCC - DPT22.101	Object RTSM - DPT21.107	Object RTC - DPT22.103
Controller error status	✓ (bit 0)	☒	✓ (bit 0)
Operating mode	✓ (bit 8)	☒	✓ (bit 1)
Controller disabled	✓ (bit 12)	☒	✓ (bit 2)
Frost alarm	✓ (bit 13)	☒	✓ (bit 3)
Heat alarm	✓ (bit 14)	☒	✓ (bit 4)
Controller inactive	☒	☒	✓ (bit 5)
Additional level active	☒	☒	✓ (bit 6)
Open window	☒	✓ (bit 0)	☒
Comfort mode extension	☒	✓ (bit 3)	☒

"Presence status indication" and "Inverted presence status indication"

These functions can be configured for each status LED if the rocker or button is configured to "room temperature control point" with the "presence" function.

When the presence status is indicated, the LED evaluates the value of the object "RTC control point - presence - status" and switches either on or off, depending on the parameter configuration in the ETS.

"Setpoint value shift indication"

This function can be configured for each status LED if the rocker or button is configured to "room temperature controller control point" with the "setpoint temperature shift" function.

When the setpoint temperature shift is indicated, the LED evaluates the value of the object "RTC control point - setpoint temperature shift - status" and switches optionally on or off, depending on the parameter configuration in the ETS.

Function of the status LED "Auto/manual fan control status display":

The room temperature controller function must also be switched on the "General" parameter page for this LED function in order for a status LED to indicate the auto/manual fan control status of a room temperature controller. When a fan controller is indicated, the LED evaluates the current status of the fan controller of the internal controller and switches either on or off, depending on the parameter configuration in the ETS. Depending on the project design, the status display is performed for automatic fan controller or manual controller.

"Comparator without sign (1-byte)" and "Comparator with sign (1-byte)"

The status LED can indicate whether a parameterized reference value is greater than, equal to or less than the 1-byte object value of the status object. This comparator can be used for unsigned (0 … 255) or for signed integers (-128 … 127). The data format of the comparison is defined by the function of the status LED.

The status LED lights up only if the comparison is "true".

After a reset or after ETS programming, the value of the LED object is always "0".

"Logic link"

The status LED indicates the initial state of the internal logic gate. The logic link is separated from the button or rocker function. The logic gate has up to 8 input objects. The inputs can optionally be OR, AND or XOR linked. The status LED is switched on if the initial state corresponds to "1".

After a bus reset or after ETS programming, the value of the LED objects is always "0".

"Bit-coded evaluation"

The bit-coded evaluation logically links individual bits. The bits to be linked are selected in the ETS. The type of evaluation (1-byte, 2-byte or 4-byte) can be configured for this purpose. The status LED is switched on according to the parameterised linking behaviour (AND, OR).

After a bus reset or after ETS programming, the value of the LED object is always "0".

10.11.2 Brightness settings

The brightness of all status LEDs is defined in the ETS. The "Brightness" parameter on the "TSM/TSEM -> Configuration TSM/TSEM" parameter page can be used to jointly set the regular brightness of all status LEDs in 6 levels (level 0 = OFF,

level 1 = dark, ..., level 5 = bright).
With the push-button sensor extension module, this setting also applies to the labelling field illumination.

Brightness reduction

Optionally, the brightness of the status LED can be changed during operation of the push-button sensor, controlled by the brightness reduction. Changing may be advisable, for example, to reduce the brightness during nighttime hours. If switching the brightness by means of the object is required, "brightness reduction" must be activated on the "TSM/TSEM -> Configuration TSM/TSEM" parameter page. In this case the "brightness reduction" communication object will become visible in the ETS. As soon as a "1" telegram is received via this object, the push-button sensor switches over to the "Reduced brightness at push-button sensor basic module" or "Reduced brightness at extension module push-button sensor" configured in the ETS ("Brightness reduction" parameter page). If a "0" telegram is received via the object, the push-button sensor switches back to regular brightness.

i With the push-button sensor extension module, the reduced brightness set for the status LED also applies to the operation LED and the labelling field.

10.11.3 Colour settings

User-defined colour setting, superimposed function and automatic colour change

The colour of the status LEDs can be adjusted. If no 3-colour individual control is configured in the parameterisation, red, green and blue can be selected from for the status LED colours in the ETS. In the colour configuration, a distinction is made between whether all of the status LEDs of the basic device or extension module have the same colour (common colour setting), or whether alternatively different colours can be configured for the LEDs (separate colour setting). The difference is as follows...

– All status LEDs have the same colour.
  If common colour setting is desired, then the "Colour" parameter on parameter page "TSM/TSEM - Configuration TSM/TSEM" must be configured to the settings "red", "green" or "blue". The status LEDs light up later during operation of the TSM or of the TSEM unchangeably in the configured colour, if they are switched on.
– The status LEDs have various colours.
  If the separate colour setting is desired, then the parameter "Colour" on parameter page "Configuration TSM/TSEM" must be configured to the setting "Colour selection per status LED". In this case additional parameters become visible on the parameter pages of the individual status LEDs. The parameters "Colour of the status LED" can then be used individually to define the desired colour for each status LED. The LED lights up in the configured colour if it is subsequently switched on regularly in operation, in accordance with the basic configuration "Function of the status LED".

In addition, with separate colour setting it is possible to configure a superposed function separately for each status LED. The superposed function can be used change the colour of a status LED via a communication object during operation of the device. It is also possible here to change the display function. The superposed function of a status LED is enabled when the parameter with the same name is configured to "active" on the corresponding parameter page. When a superposed function is enabled, additional parameters and a communication object become visible in the ETS. It is thus possible to configure which colour the status LED should have when a superposed function is active, and which display function is then executed. The parameter "Selection of the superposed LED function" defines the display function, and thus the data format of the object. The following selections are available:
"Control via separate LED object" (1-bit) or alternatively
"Comparator without / with sign" (1-byte). The fundamental function of these superposed display functions is the same as the functions of the basic display of a status LED.
In accordance with the selection of the display function and the parameter configuration resulting from it, the superposed function can be switched on or off via the 1-bit or 1-byte object. The status LED will only light up in the superposed colour when a function is switched on. When a superposed function is switched off the status LED will be activated according to its basic configuration (regular colour and display function).

For the user-defined colour settings, an automatic colour change can be configured for the LED functions "Operating mode display", "Controller status", "Setpoint shift" and "Comparator". In this case, the colour of the corresponding status LED does not depend on the user specification via ETS parameter or communication object (superimposed function). Instead, the device then automatically decides which in colour the status LED should light up, based on the function value. The parameter "Status LED = ON for" indicates the colour which is set in dependence on the function value. This parameter cannot be changed.

i The superposed function is initially always inactive after a device reset. The superposed function is only executed when a telegram is received via the corresponding object.

i Regardless of the basic configuration of the status LED and the superposed function, the LEDs always flash red when an alarm message indication is active. An alarm message has a higher priority and thus overrides the basic display and the superposed function. After deactivation of the alarm signalling, all LEDs will immediately return to the state corresponding to their configuration and communication objects.

i During colour configuration it must be ensured that different colours are configured for the basic display and the superposed function. If this is not done (the colours are the same), then when the display is static it is not possible to determine which display function is being indicated.

ℹ When the superposed function is activated via a 1-bit object it is possible to have the status LED flash in the superposed colour. During flashing the status LED switches cyclically between the "switched-on" and "switched-off" states. No colour change is performed between the regular colour and the superposed colour.

ℹ The configuration of user-defined colours of the status LED and the superimposed functions is only possible in the described manner when the 3-colour individual control is not parameterised.

3-colour individual control with separate communication objects

Each status LED can visualise statuses completely separately from the buttons, using three separate communication objects. In this case, a 1-bit object can be configured in the ETS for each colour, whereby each status LED can be statically switched on or off via the received object value, or also activated as flashing. At the same time, the colour of the LED is predefined by the actuated object.

The colour, in which the LED should light up, depends on which of the three objects of the LED concerned last receives a value. If two or all of the three objects of a LED are associated with a group address, no receiving sequence is recognisable. In this case, it is stipulated that the sequence green -> blue -> red then applies.

For a 3-colour individual control, the telegram polarity of the LED control can be configured on the parameter page of a status LED as follows:
- 1 = LED static ON / 0 = LED static OFF
- 1 = LED static OFF / 0 = LED static ON
- 1 = LED flashes / 0 = LED static OFF
- 1 = LED static OFF / 0 = LED flashes

A flashing LED always changes between the active colour and the OFF state. Flashing between several colours, e.g. red and green, is not possible.

The configuration of the 3-colour individual control as described is only possible when no user-defined colour configuration has been parameterised.

10.11.4 Standard display function

The room controller display module can be configured and put into operation without a great deal of project design work using a standard operating and display function.

This function can be switched on or off using the parameter "Standard display function (TSM/TSEM)" on the parameter page "Configuration TSM/TSEM".

ℹ With the TSEM, the standard display function can only be activated with the 4-gang version, as this is the only version with a sufficient number of LEDs.

When the standard display function is switched on, the status LEDs of the device optionally execute the following functions:

– The left or right row of status LEDs continuously visualise the current setpoint temperature shift of a controller.

– All 8 status LEDs visualise the fan level of a controller temporarily after a fan level adjustment.

Both functions of the status display function can be enabled together. The enabled standard display function can be adjusted on the "Standard display function" parameter page according to the user's requirements.

The precondition for a functioning standard display function is the project design of the room temperature controller and the configuration of the TSM.

If the standard display function is activated, the following parameters are permanently set: "Function and colour of all status LEDs = User-defined ..." and "Colour of all status LEDs = Colour selection per status LED".

Predefined status LED functions

With the enabled standard display function of the room controller module, the LED functions of the basic module are optionally predefined. The standard display function contains the indication of the setpoint shift and the temporary fan level indication via the status LED.

The status LEDs are internally connected to the controller. No group addresses need be assigned.

Standard display function: Setpoint temperature shift

In the ETS, the parameter "Side of LED row" defines whether the device shows the status of the current setpoint temperature shift using four status LEDs. The parameter also defines the side of the device upon which the current setpoint temperature shift is shown. The device either shows the current setpoint shift on the right-hand side (status LEDs 2, 4, 6 and 8) or on the left-hand side of the device (status LEDs 1, 3, 5 and 7). A positive adjustment is represented by a red illuminated status LED and a negative adjustment by a blue status LED. The status LEDs of the selected side are permanently set to the visualisation of the setpoint shift and cannot be changed further on the parameter pages of the status LED. By contrast, the status LEDs of the unselected side can be designed freely when the standard display function is active.

The parameter "Display" on the "Configuration TSM/TSEM" parameter page determines whether the setpoint shift standard display function is displayed in two (see figure 45) or 4 steps (see figure 43).

Furthermore, the state of the selected status LED row can be configured in case the setpoint is not shifted (see figure 46).

Setpoint shifting display: 4 steps in each direction

With the "4 steps per direction" display, all four right status LEDs of the selected side are allocated to the respective current state of the negative or positive adjustment. All four status LEDs display the current setpoint shift depending on the configured increment. The display of the negative adjustment starts at the top and builds up (with steadily increasing adjustment) downwards. The positive adjustment starts at the top and builds up (with steadily increasing adjustment) downwards.

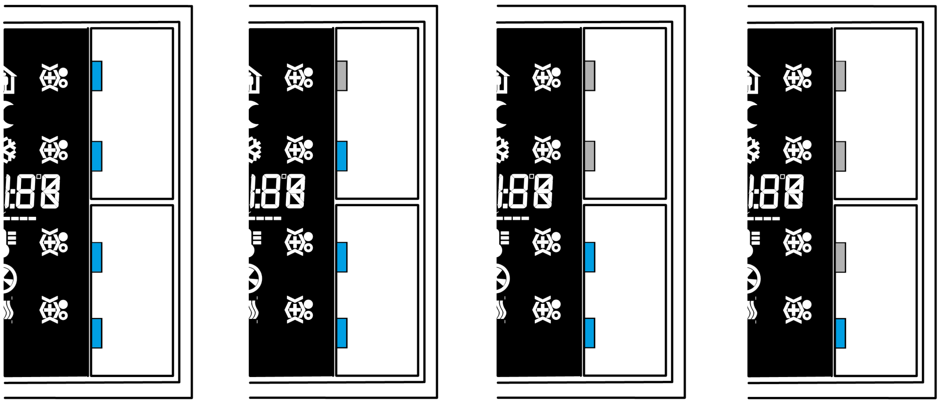

Figure 43: Standard display function: negative setpoint shift "4 steps"

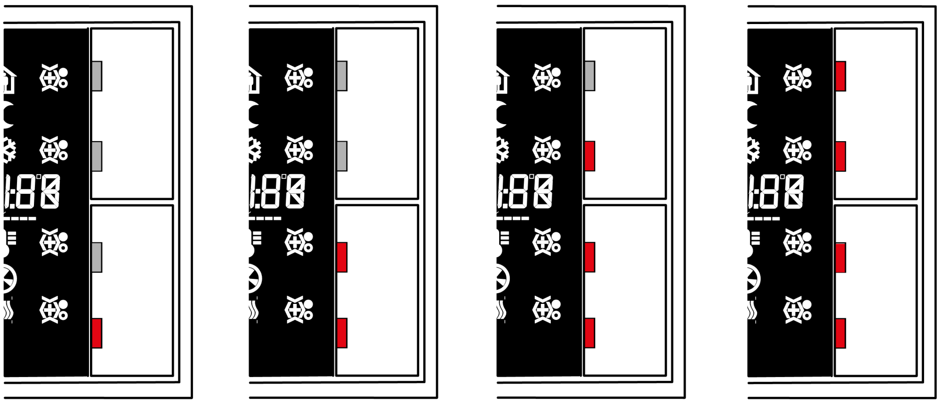

Figure 44: Standard display function: positive setpoint shift "4 steps"

Setpoint shifting display: 2 steps in each direction

With the "2 steps in each direction" display, the two upper status LEDs (status LEDs 2 and 4 or 1 and 3) of are allocated to the positive adjustment and the two lower right status LEDs (status LEDs 6 and 8 or 5 and 7) are allocated to the negative adjustment. The current setpoint shift is displayed with the two corresponding status LEDs depending on the configured increment. The display of the negative and positive adjustment starts in the centre of the device and builds up (with steadily increasing adjustment) from the centre outwards, depending on the direction of the adjustment.

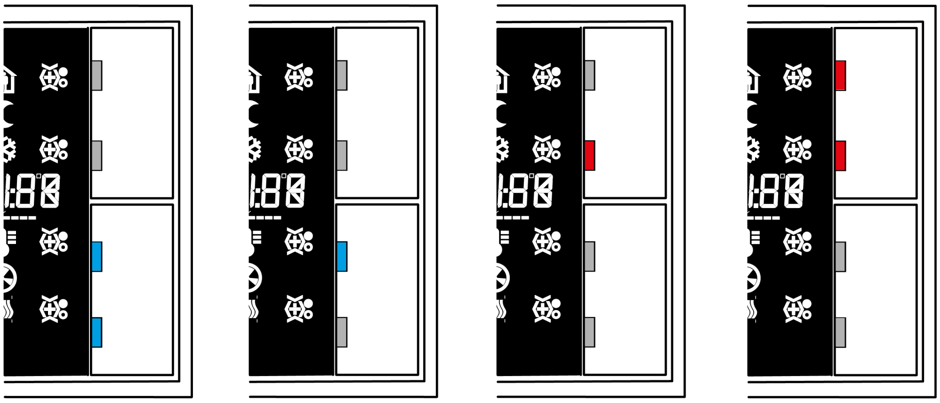

Figure 45: Standard display function: Setpoint shift display "2 steps"

Setpoint shift display: No adjustment

During the standard display function, various types of display for displaying the state of the setpoint shift = 0, i.e. no adjustment, can be configured.

Configurable display forms for "No adjustment" are:

- Standard (no status LED lights up)
- 1 LEDs green (status LED 6 lights up green)
- 2 LED green (status LEDs 4 and 6 light up green)
- 4 LED green (status LEDs 2, 4, 6 and 8 light up green)

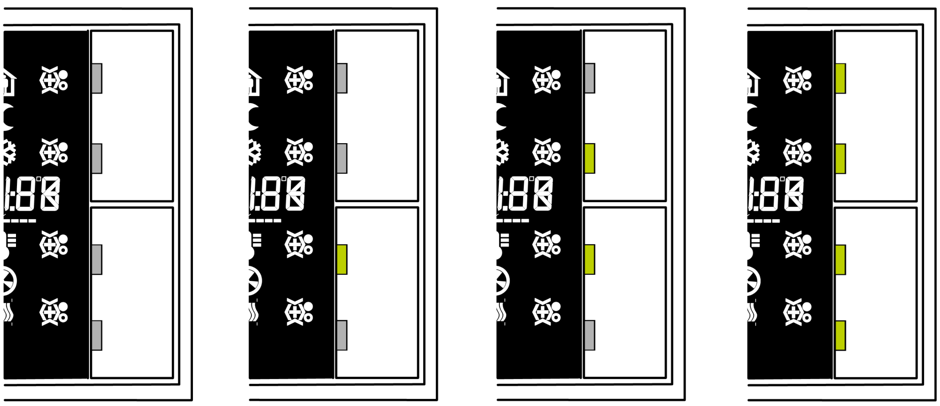

Figure 46: Standard display function: Setpoint value shift display "No adjustment"

If the standard display function is enabled, the status LEDs of the selected side cannot be changed and are permanently assigned to the setpoint shift.

Standard display function: temporary fan level display

One function to be regarded as an extension of the LED function "Fan controller display" is the "Temporary fan level display".

The temporary fan level display is displayed in combination with all 8 status LEDs of the device for the light period of the button-press display. The current fan level is always displayed in blue and takes place in clockwise direction, beginning with status LED 7 (bottom left) via status LED 5, status LED 3, status LED 1, status LED 2, status LED 4 and status LED 6 until status LED 8.

Fan level	Status LED	Switching state
0	7, 5, 3, 1, 2, 4, 6, 8	OFF
1	7	ON
2	7, 5	ON
3	7, 5, 3	ON
4	7, 5, 3, 1	ON
5	7, 5, 3, 1, 2	ON
6	7, 5, 3, 1, 2, 4	ON
7	7, 5, 3, 1, 2, 4, 6	ON
8	7, 5, 3, 1, 2, 4, 6, 8	ON

Temporary fan level display: Status LED of switching states

No remaining LED functions (except for alarm message) are executed for the duration of the temporary fan level display. Once the duration of the button-press display has elapsed, all status LEDs reassume their regular state.

10.11.5 Table of parameters

A large part of the same functions, parameters and settings as in the TSM are available for the push-button sensor extension module TSEM. Differences between TSM and TSEM only exist among parameters of the controller operation. These differences are indicated in the following list of parameters by a separate note. Thus, the settings in the extension module are independent of the settings in the basic module.

TSM/TSEM -> Configuration TSM/TSEM

Function and colour	**User-defined (selection per status LED)** 3-colour-individual control via objects
The display concept of the status LED for the TSM or TSEM is selected at this point. In the setting "User-defined", the usual LED functions are available, e.g. status display or button-press display. These also include the user-defined colour selection and the superimposed display of several functions. The settings are selected separately for each status LED on the corresponding parameter page. Alternatively, the different colours of each status LED can be addressed via their own communication objects. The setting "3-colour individual control via objects" is valid for all the status LEDs of the TSM or TSEM. 3 objects are created for each module (TSM & TSEM) for the three colours (switching colour red, switching colour green and switching colour blue). The object which received its value last determines the colour that the status LED lights up in. This setting causes the additional parameter "Control of the status LED via object value" to be shown on the parameter pages of the status LED. Only with TSM: Depending on the parameter "Standard display function", this parameter is not set visibly to user-defined.	

Colour	**Red** Green Blue Colour selection per status LED
With a user-defined colour configuration, a distinction is made between whether all of the status LEDs have the same colour (settings "red", "green" or "blue"), or whether alternatively various colours can also be configured for the LEDs (setting "User-defined" (Colour selection per status LED)"). With colour selection per status LED, it is possible to set the colour on the parameter pages of the individual status LEDs. This parameter is only visible with user-defined function and colour selection. Only with TSM: Depending on the parameter "Standard display function (...)", this parameter is not set visibly to "Colour selection for each status LED".	

Light duration of status LED for button-actuation display	1 s 2 s **3 s** 4 s 5 s
This parameter defines the switch-on time the status LED is lit up to indicate actuation. The setting concerns all status LEDs whose function is set to "Button-actuation display".	

Brightness	Level 0 (OFF) Level 1 (dark) Level 2 Level 3 **Level 4** Level 5 (bright)
The brightness level for all status LEDs of the push-button sensor basic module is defined here.	

Standard display function	Active **Inactive**
With the help of this parameter, the standard display function of the TSM or TSEM is enabled. With the enabled standard display function of the room controller module, the LED functions of four status LEDs of the basic module are predefined. The standard display function contains the indication of the setpoint shift and the temporary fan level indication via the status LED. If the standard display function is activated, the following parameters are permanently set: "Function and colour of all status LEDs = User-defined ..." and "Colour of all status LEDs = Colour selection per status LED". With the TSEM, the standard display function can only be activated with the 4-gang version.	

Brightness reduction	Active **Inactive**
Whether the parameter and communication object for reducing the brightness for all status LEDs, the operation LED and for the labelling field illumination should be shown is defined here. i If a button operation takes place when reduced brightness is activated, then all the active displays are displayed with the regular brightness for a period of about 30 seconds.	

TSM -> Configuration TSM -> Brightness reduction

Reduced brightness at basic module push-button sensor	Level 0 (OFF) **Level 1 (dark)** ... Level 5 (bright)
The brightness of all status LEDs is reduced to the specified level as soon as the communication object "TSM brightness reduction - Input" receives the value "1". ℹ There is no check of whether the reduced level has a lower value than the regular brightness level.	

TSEM -> Configuration TSEM -> Brightness reduction

Reduced brightness at extension module push-button sensor	Level 0 (OFF) **Level 1 (dark)** ... Level 5 (bright)
The brightness of all status LEDs, the operation LED and the labelling field illumination is reduced to the specified level as soon as the communication object "TSEM brightness reduction - Input" receives the value "1". ℹ There is no check of whether the reduced level has a lower value than the regular brightness level.	

Configuration TSEM

Operation LED: Function and colour	**User-defined** 3-colour control via objects
At this point, the display concept of the operation LED is selected. In the setting "User-defined", the colour is permanently selected and the operation LED can be statically switched on or off, addressed via an object or automatically switched off after the last operation. Alternatively, the different colours of the operation LED can be addressed via its own communication objects (setting "3-colour control via objects").	

Operation LED: Function	Disabled **Enabled** Control via object Button-actuation indication
This parameter defines the user-defined function selection of the function of the operation LED. The operation LED can be permanently on or off or alternatively be switched via a communication object. Optionally the operation LED can be switched on by pressing any desired button and switched off again automatically after a delay time has elapsed. Here the parameter "Operating LED light duration" defines the delay until switch-off after the last button-press. Each button-press re-initiates the delay time. This parameter is only visible with user-defined function and colour selection.	

Operation LED light duration	0 ... **5**...20 min 0 ... **10** ... 59 s
If the "Function of the operation LED" is set to "Button-actuation display", the delay before switch-off after the last button-press can be configured here.	

Operation LED: Object polarity	**1 = ON / 0 = OFF** 0 = ON / 1 = OFF 1 = Flashing / 0 = OFF 0 = Flashing / 1 = OFF
If the "Function of the operation LED" is set to "Control via object", then the telegram polarity of the 1-bit object of the operation LED can be specified at this point. The LED can be switched on or off statically. In addition, the received switching telegram can be evaluated in such a way that the LED flashes.	

Operation LED Colour	Red Green **Blue**
The colour of the operation LED is selected at this point. This parameter is only visible with user-defined function and colour selection.	

Labelling field illumination: Function	Disabled **Enabled** Control via object Button-actuation indication
This parameter defines the function of the labelling field illumination. The labelling field illumination can be permanently on or off or alternatively be switched via a communication object. Optionally the labelling field illumination can be switched on by pressing any desired button and switched off again automatically after a delay time has elapsed. Here the parameter "Light duration of labelling field" defines the delay until switch-off after the last button-press. Each button-press re-initiates the delay time.	

Labelling field illumination: Object polarity	**1 = ON / 0 = OFF** 0 = ON / 1 = OFF 1 = Flashing / 0 = OFF 0 = Flashing / 1 = OFF
If the "Function of the labelling field illumination" is set to "Control via object", then the telegram polarity of the 1-bit object "Labelling field illumination - Input" can be specified at this point. The illumination can be switched on or off statically. In addition, the received switching telegram can be evaluated in such a way that the illumination flashes.	

Light duration of labelling field	0 ... **5**...20 min 0 ... **10** ... 59 s
If the "Function of the labelling field illumination" is set to "Button-actuation display", the delay before switch-off after the last button-press can be configured here.	

Status LED, operation LED and labelling field illumination: Brightness	Level 0 (OFF) Level 1 (dark) Level 2 Level 3 **Level 4** Level 5 (bright)
The brightness is set centrally for the entire TSEM here. The setting is made independently of the TSM.	

Button *n* -> Status LED *n* - Function

Function of status LED	Always OFF Always ON **Button-actuation indication** Telegram acknowledgment Status indication Inverted status display Control via separate LED object Operating mode indication Controller status indication Setpoint value shift indication Presence status indication Inverted presence status indication Auto/manual fan control status display Inverted auto/manual fan control status display Comparator without sign (1-byte) Comparator with sign (1-byte) Logic link Bit-coded evaluation
The ETS automatically compiles the selection of functions of the status LED depending on the set rocker or button function. Only functions that make sense in combination with the parameterised rocker or button function are offered for selection.	

The following selection of status LED basic functions can be configured for each rocker or button function.

Function of status LED	Always OFF Always ON Control via separate LED object Operating mode indication Controller status indication Comparator without sign (1-byte) Comparator with sign (1-byte) Logic link Bit-coded evaluation

Always OFF: Irrespective of the button or rocker function, the status LED is switched off permanently.

Always ON: Irrespective of the button or rocker function, the status LED is switched on permanently.

Control via separate LED object: The status LED indicates the state of its own, separate 1-bit LED object. This setting causes the additional parameter "Control of the status LED via object value" to be shown.

Operating mode display: The status LED indicates the state of a KNX room temperature controller via a separate 1-byte communication object. This setting causes the additional parameter "Status LED ON with" to be shown.

Controller status display: The status LED indicates the state of the internal room temperature controller or the controller extension. This setting causes the additional "controller status" and "Status LED on with" parameters to be displayed.

Comparator without sign (1-byte): The status LED is activated depending on a comparison. In this configuration there is a separate 1-byte communication object available via which the unsigned reference value (0...255) is received. This setting causes the additional parameter "Status LED ON with" to be shown.

Comparator with sign (1-byte): The status LED is activated depending on a comparison. In this configuration there is a separate 1-byte communication object available via which the positive or negative reference value (-128...127) is received. This setting causes the additional parameter "Status LED ON with" to be shown.

Logic link: The status LED indicates whether the parameterised logic behaviour is fulfilled. The number of logic inputs that affect the logic output (status LED) according to the parameterised logic behaviour can be configured.

Bit-coded evaluation: The status LED indicates whether the parameterised linking behaviour is fulfilled. Up to 32-bits can be evaluated. All activated bits affect the lighting behaviour of the status LED according to the parameterised link behaviour.

The following selection of status LED functions can be configured in addition to the basic functions for the rocker or button functions "switching" and "dimming and colour temperature".

Function of status LED	Button-actuation indication Status indication Inverted status display
Button-actuation display: The status LED indicates a button actuation. The ON time is set on the parameter page "Configuration TSM" in common for all status LEDs that are configured as actuation displays. Status display: The status LED indicates the state of the communication object "Switching". If the object value is "ON", the status LED is illuminated. If the object value is "OFF" the status LED is switched off. Inverted status display: The status LED indicates the state of the communication object "Switching". If the object value is "OFF", the status LED is illuminated. If the object value is "ON" the status LED is switched off.	

The following status LED function can be configured **in addition** to the basic functions for the rocker or button function "Short and long button actuation".

Function of status LED	Telegram acknowledgment
Telegram acknowledgement: The status LED indicates the transmission of a telegram for the communication object "short and long button actuation".	

The following selection of status LED functions can be configured **in addition** to the basic functions for the rocker or button function "Room temperature controller control point -> Presence function".

Function of status LED	Button-actuation indication Presence status indication Inverted presence status indication
Button-actuation display: The status LED indicates a button actuation. The ON time is set on the parameter page "Configuration TSM" in common for all status LEDs that are configured as actuation displays. Presence status indication: The status LED indicates the status of the presence function of the controller operation or a room temperature controller control point. The LED lights up if the presence function is activated. The LED is off if the presence function is inactive. Inverted presence status indication: The status LED indicates the status of the presence function of the controller operation or a room temperature controller control point. The LED lights up if the presence function is inactive. The LED is off if the presence function is activated.	

The following selection of status LED functions can be configured **in addition** to the basic functions for the rocker or button function "Room temperature controller control point -> Setpoint temperature shift".

<table>
<tr><td>Function of status LED</td><td>Button-actuation indication
Setpoint temperature shift indication</td></tr>
<tr><td colspan="2">Button-actuation display: The status LED indicates a button actuation. The ON time is set on the parameter page "Configuration TSM" in common for all status LEDs that are configured as actuation displays.
Setpoint temperature shift indication: The status LED indicates the status of a setpoint temperature shift of the controller operation or a room temperature controller control point. This setting causes the additional parameter "Status LED" to be shown.</td></tr>
</table>

The following selection of status LED functions can be configured in addition to the basic functions for the rocker or button function "Room temperature controller control point -> Fan control auto/manual".

<table>
<tr><td>Function of status LED</td><td>Button-actuation indication
Auto/manual fan control status display
Inverted auto/manual fan control status display</td></tr>
<tr><td colspan="2">Button-actuation display: The status LED indicates a button actuation. The ON time is set on the parameter page "Configuration TSM" in common for all status LEDs that are configured as actuation displays.
Fan control auto/manual status indication: The status LED indicates the status of the fan control of the controller operation or a room temperature controller control point. The LED lights up when the fan control takes place automatically. The LED is out when the fan control takes place manually.
Fan control auto/manual inverted status indication: The status LED indicates the status of the fan control of the controller operation or a room temperature controller control point. The LED lights up when the fan control takes place manually. The LED is out when the fan control takes place automatically.</td></tr>
</table>

Colour of the status LED	**State OFF = LED off, state ON = red** State OFF = LED off, state ON = green State OFF = LED off, state ON = blue State OFF = red, state ON = green State OFF = red, state ON = blue State OFF = green, state ON = red State OFF = green, state ON = blue State OFF = blue, state ON = red State OFF = blue, state ON = green
If separate colour settings for the status LEDs are required, then this parameter can be used individually to define the desired colour for each status LED. The LED lights up in the configured colour if it is subsequently switched on regularly in operation of the push-button sensor in accordance with the basic configuration "Function of the status LED". This parameter is only visible if the parameter "Colour selection of all status LEDs" on parameter page "General" is set to "Colour selection per rocker/button". This parameter is only visible when no automatic colour change is configured.	

The superimposed function is visible if the "Function and colour" of the LED is set to "User-defined (selection per status LED)" in the TSM/TSEM configuration and "Colour selection per status LED" has been selected under Colour.

Superposed function	Inactive Active
When the superimposed function is active, further parameters appear that enable the status LED to be activated in a different colour.	

Selection of the superposed function	**Control via separate LED object (1-bit)** Comparator without sign (1-byte) Comparator with sign (1-byte)
Here, you can select whether the superimposed function is controlled via a 1-bit or 1-byte object.	

Colour of the superposed status LED	**State ON = red** State ON = green State ON = blue
This parameter is used to select the colour of the status LED with superimposed function.	

Control of the status LED via object value	**1 = superp. funct. ON / 0=superp. funct. OFF** 1 = superp. funct. OFF / 0=superp. funct. ON 1 = superp. funct. flashes / 0=superp. funct. OFF 1 = superp. funct. OFF / 0=superp. funct. flashes
The object value used to control the superimposed function is set here. Flashing can also be activated here.	

The following parameter is visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "control via separate LED object".

Control of the status LED via object value	**1 = LED static ON / 0 = LED static OFF** 1 = LED static OFF / 0 = LED static ON 1 = LED flashes / 0 = LED static OFF 1 = LED static OFF / 0 = LED flashes
This parameter defines the telegram polarity of the 1-bit object "status LED". The LED can be switched on or off statically. In addition, the received switching telegram can be evaluated in such a way that the LED flashes.	

The following parameter is visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Operating mode display".

Status LED ON with	Automatic mode **Comfort mode** Standby mode Night mode Frost/heat protection mode
The values of a communication object with data type 20.102 "HVAC Mode" are defined as follows: 0 = Automatic 1 = Comfort 2 = Standby 3 = Night 4 = Frost/heat protection The value "Automatic" is used only by the "forced operating mode switch-over" objects. The status LED is illuminated when the object receives the value configured here.	

The following parameters are visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Controller status indication".

Status LED ON with	**Controller error status** Operating mode (Heating = 1 / Cooling = 0) Controller disabled (dew point operation) Frost alarm Heat alarm Controller inactive (deadband operation) Comfort mode extension Open window Additional level active
The status LED shows the information of the controller status according to the parameterization.	

The following parameters are visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Comparator without sign".

Status LED ON with	**Reference value greater than received value** Reference value less than received value Reference value equal to received value
The status LED indicates whether the configured reference value is greater or less than or equal to the value of the "Status LED" object".	

Reference value	**0**...255
This parameter defines the reference value to which the value of the "Status LED" object is compared.	

The following parameters are visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Comparator with sign".

Status LED ON with	**Reference value greater than received value** Reference value less than received value Reference value equal to received value
The status LED indicates whether the configured reference value is greater or less than or equal to the value of the "Status LED" object".	

Reference value	-128...**0**...127
This parameter defines the reference value to which the value of the "Status LED" object is compared.	

The following parameters are visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Logic link".

Logic behaviour	**OR** AND XOR
The status LED indicates whether the parameterised logic behaviour is fulfilled. If "OR", the status LED lights up as soon as an input is true ("1"). If "AND", the status LED lights up when all inputs are true ("1"). If "XOR", the status LED lights up when an odd number of inputs are true ("1").	

Number of logic inputs	**2** ... 8
Here, the number of logic inputs that affect the logic output (status LED) according to the parameterised logic behaviour is configured.	

The following parameters are visible on the parameter pages "Status-LED *n* - function" if the function of the status LED is configured to "Bit-coded evaluation".

Linking behaviour	**OR** AND
The status LED indicates whether the parameterised linking behaviour is fulfilled. If "OR", the status LED lights up as soon as an input is true ("1"). If "AND", the status LED lights up when all inputs are true ("1").	

Type of evaluation	**1-byte** 2-byte 4-byte
The type of evaluation and thus the number of bytes is configured here. According to this setting, the ETS displays a table for selecting the individual bits. Up to 32 bits can be activated for the evaluation. All activated bits affect the lighting behaviour of the status LED according to the parameterised link behaviour.	

The following parameters are valid for: Standard display function (TSM) and standard display function (TSEM).

i With the TSEM, the standard display function is only available with the 4-gang version.

TSM/TSEM -> Configuration TSM/TSEM -> Standard display function

Setpoint shift	Active **Inactive**
Here, you can set whether the device should display a setpoint shift via the status LED.	

Side of the LED line	**Left** Right
This parameter defines whether the device shows the status of the current setpoint shift using four status LEDs and the side of the device showing the current setpoint shift. The device either shows the current setpoint shift on the right-hand side (status LEDs 2, 4, 6 and 8) or on the left-hand side of the device (status LEDs 1, 3, 5 and 7). A positive adjustment is represented by a red illuminated status LED and a negative adjustment by a blue status LED. The status LEDs of the selected side are permanently set to the visualisation of the setpoint shift and cannot be changed on the parameter pages of the status LED. By contrast, the status LEDs of the unselected side can be designed freely when the standard display function is active.	

Setpoint source	**Room temperature controller function 1** Room temperature controller function 2
The standard display function can be set up for one of the two room temperature controller functions. This parameter defines the controller. Output of the setpoint shift is orientated to the setpoint of this controller.	

Illustration	2 steps in each direction **4 steps in each direction**
This parameter defines how the setpoint shift is displayed. Furthermore, this parameter defines by how many steps the setpoint can be shifted if the standard display function is enabled. In the "4 steps in each direction" setting, all 4 status LEDs are used once to indicate the positive setpoint shift and also to indicate a negative setpoint shift. Positive adjustments are indicated by red illuminated LEDs and negative adjustments by green illuminated LEDs. If "2 steps in each direction" are configured, both upper status LEDs are used to indicate the positive shift, and both lower status LEDs are used to indicate the negative shift.	

Display "no adjustment"	**Standard** 1 LED green 2 LEDs green 4 LED green
In the event that there is no setpoint shift, the behaviour can be set to user-oriented with this parameter. These options are available: - Standard (LED switched off) - 1 LED green (status LED 5 or 6) - 2 LED green (status LED 3+5 or 4+6) - 4 LED green (status LED 1+3+5+7 or 2+4+6+8)	

Temporary fan level display	Active Inactive
Here, you can set whether the device should display the currently active fan levels via the status LED. The temporary fan level display is displayed in combination with all 8 status LEDs of the device for the light period of the button-press display. The current fan level is always displayed in blue and takes place in clockwise direction, beginning with status LED 7 (bottom left) via status LED 5, status LED 3, status LED 1, status LED 2, status LED 4 and status LED 6 until status LED 8.	

Source for the temporary fan level display	Room temperature controller function 1 Room temperature controller function 2
Room temperature controller function 1 Room temperature controller function 2: This parameter enables the temporary fan level display depending on various functions. When the fan level changes, this function displays the current fan level with the help of all 8 status LEDs. The current fan level is always displayed in blue. The duration of the temporary display is determined by the parameter "Light duration for button-actuation display".	

10.11.6 Object list

The following communication objects are available for the individual status LEDs, depending on the set operating concept. The name of the object corresponds to the selection of the operating concept and can be adjusted by the "Name of status LED" parameter.

Function	Name	Type	DPT	Flag
Switching	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED.				

Function	Name	Type	DPT	Flag
Operating mode indication	TSM/TSEM - Status LED *n* - Input	1-byte	20,102	C, -, W, -, U
1-byte object for activation of the status LED.				

Function	Name	Type	DPT	Flag
RHCC controller status - KNX-compliant	TSM/TSEM - Status LED *n* - Input	2-byte	22,101	C, -, W, -, U
2-byte object for activation of the status LED.				

Function	Name	Type	DPT	Flag
Controller status RTSM - KNX-compliant	TSM/TSEM - Status LED *n* - Input	1-byte	21,107	C, -, W, -, U
1-byte object for activation of the status LED.				

Function	Name	Type	DPT	Flag
Controller status RTC - KNX-compliant	TSM/TSEM - Status LED *n* - Input	2-byte	22,103	C, -, W, -, U
2-byte object for activation of the status LED.				

Function	Name	Type	DPT	Flag
Value (0...255)	TSM/TSEM - Status LED *n* - Input	1-byte	5,010	C, -, W, -, U
1-byte object for activation of the status LED according to the parameter setting.				

Function	Name	Type	DPT	Flag
Value (-128...127)	TSM/TSEM - Status LED *n* - Input	1-byte	6,010	C, -, W, -, U
1-byte object for activation of the status LED according to the parameter setting.				

Function	Name	Type	DPT	Flag
Logic link input 1	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 1 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 2	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 2 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 3	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 3 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 4	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 4 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 5	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 5 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 6	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 6 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 7	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 7 of the logic link.				

Function	Name	Type	DPT	Flag
Logic link input 8	TSM/TSEM - Status LED *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the status LED according to the parameter setting. This object describes the input 8 of the logic link.				

Objects for the TSEM:

Function	Name	Type	DPT	Flag
Control	TSEM - Operation LED - Input	1-bit	1,001	C, -, W, -, U
1-bit object for switching the operation LED of the connected TSEM on or off ("1" = switch on; "0" = switch off).				

Function	Name	Type	DPT	Flag
Switching colour red [green, blue]	TSEM - Operation LED - Input	1-bit	1,001	C, -, W, -, U
1-bit object for switching the red (blue, green) colour of the operation LED of the TSEM in the case of 3-colour control via objects on or off ("1" = switch on; "0" = switch off).				

Objects for labelling field illumination and brightness:

Function	Name	Type	DPT	Flag
Control	TSEM - Labelling field illumination - Input	1-bit	1,001	C, -, W, -, U
1-bit object for switching the labelling field illumination of the TSEM on or off ("1" = switch on; "0" = switch off).				

Function	Name	Type	DPT	Flag
Activate/deactivate	TSEM - Brightness reduction - Input	1-bit	1,001	C, -, W, -, U
1-bit object for reducing the brightness of all status LEDs of the TSEM. If the TSEM is connected, this object also reduces the labelling field illumination and the operation LED ("1" = reduce; "0" = normal operation).				

11 Channel-independent device functions

The following subchapters provide a description of the device functions. Each subchapter consists of the following sections:

– Functional description
– Table of parameters
– Object list

Functional description

The functional description explains the function and provides helpful tips on project design and usage of the function. Cross references support you in your search for further information.

Table of parameters

The table of parameters lists all parameters associated with the function. Each parameter is documented in a table as follows.

Name of the parameter	Parameter values
Parameter description	

Object list

The object list specifies and describes all communication objects associated with the function. Each communication object is documented in a table.

Function	This column contains the function of the communication object.
Name	This column contains the name of the communication object.
Type	This column contains the length of the communication object.
DPT	This column assigns a datapoint type to a communication object. Datapoint types are standardized in order to ensure interoperability of KNX devices.
Flag	This column assigns the communication flags in accordance with the KNX specification.
C-Flag	activates / deactivates the communication of the communication object
R-Flag	enables externally triggered reading of the value from the communication object
W-Flag	enables externally triggered writing of the value to the communication object
T-Flag	enables transfer of a value
U-Flag	enables updating of an object value in case of feedback
I-Flag	enforces updating of the communication object value when the devices is switched on (reading at init)

11.1 Display

Introduction

On the front side of the device, between the control surfaces, there is a LC display (LCD = Liquid crystal display) with switchable backlighting. On the display, icons signal various operating states of the integrated room temperature controller or the controller extension. In addition, up to 17 pieces of display information (actual temperature, setpoint temperature, outdoor temperature and any temperatures) can be shown either alternating over time or controlled by pressing a button on the device (see figure 47).
The device can be integrated into the switch programs A500, LS990 or CD500. The displays of the devices for the LS990 and CD500 switch ranges have the same design and differ from the display of the A500 switch range through a different arrangement of the display information. Button function icons can only be displayed on the displays with the switch ranges LS990 and CD500 .
Full-surface operation of rocker 1 can recall the menu level of the device. The content of the menu level can be configured in the ETS.

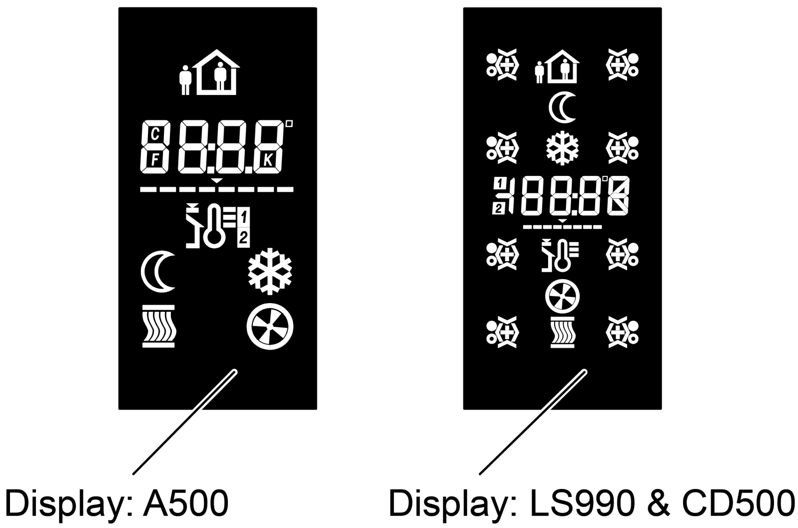

Figure 47: Device display

11.1.1 Displayed information

Icons of the room temperature controller

The table clarifies the meaning of all the display icons. The icons signal various states of the integrates room temperature controller or the controller extension and the display operation.

Icon	Meaning
	"Comfort" operating mode active. Can flash when setting the operating mode in the menu level.

Icon	Meaning
	"Standby" operating mode active. Can flash when setting the operating mode in the menu level.
	"Night" operating mode active. Can flash when setting the operating mode in the menu level.
	"Frost/heat protection" operating mode active. Flashes on frost alarm. Frost alarm is dependent on an active "Controller status": - For ("Frost protection setpoint (°C) fallen below), - For "Transmit individual state" (T_{Room} <= +7 °C / +45 °F).
	A "Night comfort extension" is active.
	A "Frost/heat protection comfort extension" is active.
---- ----	Indication of the basic setpoint in the positive " - - - -" or negative "- - - - " direction. A bar corresponds to shifting by one level value. The value of a level can be parameterised in the ETS. If no shift is active, only "" is displayed.
	Indication of a fan controller configured in the ETS (impeller) with display of the active fan level , , , ..., . If no icon is displayed, either the fan control is completely deactivated in the ETS or the fan function is activated in the ETS but is switched off.
	The controller uses this icon to signal that heating energy is being fed to the room. In continuous feedback control, the command value is indicated by the number of streaks that are visible (0 %) , (1...20 %), (21...40 %), (41...60 %), (61...80 %), (81...100 %). In 2-point feedback control, indicates a command value that is switched on and one that is switched off. This icon is also visible in the menu level for setpoint temperature settings for heating mode.
	The controller uses this icon to signal that cooling energy is being fed to the room. In continuous feedback control, the command value is indicated by the number of streaks that are visible (0 %) , (1...20 %), (21...40 %), (41...60 %), (61...80 %), (81...100 %) . In 2-point feedback control, indicates a command value that is switched on and one that is switched off. This icon is also visible in the menu level for setpoint temperature settings for cooling mode.

Table: Meaning of the display icons

Display information

In addition to the icons, it is possible to show up to 17 display functions in the display. Thus, up to 17 pieces of display information (actual temperature, setpoint temperature, outdoor temperature, any temperature) can be optionally displayed with the room temperature controller icons.
In the ETS, it is possible to configure which of this information is actually shown in the display.
The information is shown separately on the display. It is possible to change over

between the information automatically after set times or in a controlled manner by pressing a button on the device. The display information are switched in the sequence Display 1, Display 2, Display 3, ..., Display 17.

The following four figures show the possible display information in a sample sequence. Various temperatures, received by input objects of the controller or the display, are shown. In this application, Controller 1 works as the main controller and Controller 2 works as a controller extension.

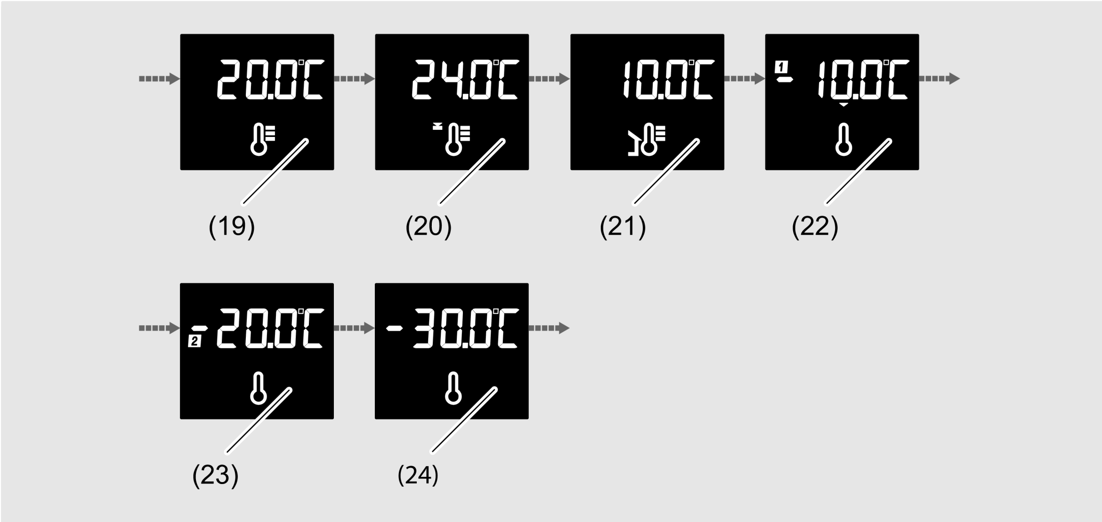

Figure 48: Possible display information of the display

(19) Display 1: Display information "Actual temperature (via object)"
(20) Display 2: Display information "Setpoint temperature (via object)"
(21) Display 3: Display information "Outdoor temperature (via object)"
(22) Display 4: Display information "Any temperature 1"
(23) Display 5: Display information "Any temperature 2"
(24) Display 6: Display information "Any temperature 3"

The graphic (see figure 48) shows an example of seven pieces of display information, recalled at different times or by a button-press. Seven items of general display information are shown. The display shows values which the device receives via the communication objects "Display - Input". These values should be regarded independently of the controllers.
In the ETS, it is possible to set the display information on the parameter pages "Display -> Display - General -> Display information". During the period, in which the device does not receive any valid values, the following wildcard is shown in the device display: "--.-°C" for temperatures.

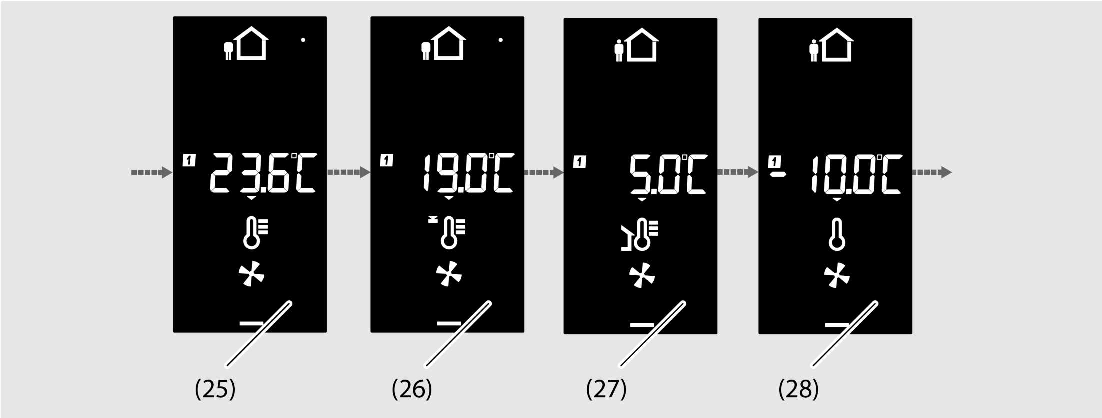

Figure 49: Possible display information of the display

(25) Display 7: Display information "Controller 1: Actual temperature + icons"

(26) Display 8: Display information "Controller 1: Setpoint temperature + icons"

(27) Display 9: Display information "Controller 1: Outdoor temperature + icons"

(28) Display 10: Display information "Controller 1: Any temperature 1 + icons"

The graphic (see figure 49) shows an example of five pieces of display information, recalled at different times or by a button-press. Display information related to controller 1 are shown. The display shows values which the devices make available (e.g. actual temperature) or is received via the communication objects "Display - Input". In the ETS, it is possible to set the display information on the parameter pages "Display -> Display - General". During the period, in which the device does not receive any valid values, the following wildcard is shown in the device display: "--.-°C" for temperatures.

Indication of temperature values

The indication of the room temperature has a resolution of 0.1 °C and covers a range from -99.9 °C to +99.9 °C. The indication will refresh as soon as the determined room temperature changes within the resolution interval. Should the room temperature reach or fall below +5 °C / +41 °F, the ❄ icon also flashes on the display as a temperature alarm.

The indication of the outdoor temperature has a resolution of 0.1 °C and also covers a range from -99.9 °C to +99.9 °C. The temperature display will refresh as soon as a temperature value telegram is received via the "Outdoor temperature" object. After a device reset, the display shows "--.-" until a telegram is received. If configured, the outdoor temperature will only be read on the display and cannot be used for any further temperature or variable calculation in the controller.

The setpoint temperature is indicated as an absolute temperature value. The currently adjusted setpoint temperature of the active operating mode is displayed. The device always rounds the indication to half degrees and shows the rounded-off temperature in the display. Its possible temperature range depends on the configured operating mode and is specified by the fixed value settings for the frost and/or heat protection temperature. The indication will refresh once a new setpoint temperature for the controller results (e. g. from a change of the operating mode or of the basic setpoint, etc.).

The display of any temperatures 1 to 3 has a resolution of 0.1 °C and also covers a range from -99.9 °C to +99.9 °C. The temperature display will refresh as soon as a temperature value telegram is received via the "Any temperature display" object. After a device reset, the display shows "--.-" until a telegram is received. If configured, any temperature will only be read on the display and cannot be used for any further temperature or variable calculation in the controller.

The temperatures can be displayed in °C or alternatively in °F. This display format can be configured in common for all temperature values in the "Display - General" parameter node of the ETS.

Indication of time information

The device possesses an internal clock, set using a communication object. The internal calculation of the current time is primarily influenced by the scope of the internally planned functions and the resulting data traffic. This may cause particularly large time deviations. For this reason, the internal clock should be synchronised on a regular basis. We recommend using, for example, an external KNX clock with DCF 77 receiver, to set the clock once an hour via the bus and thus keep the deviations as small as possible.

After a device reset, the display shows "--:--" until a time signal is received. The same indication will appear unless the internal clock has been updated via the bus at least once a day (updating check at 4:00 a.m.). In both cases, the time is invalid until the first or a new time telegram is received.

If the time is invalid, an optional automatic time poll can take place. For this, the "Request time" parameter in the "Display - General" parameter node in the ETS can be set to "Active". In this case, if the time information is invalid, the device will request time once only by sending a read telegram to the bus. The read request should the be confirmed by an other bus subscriber using an answer telegram.

The time can be displayed in the 24-hour or 12-hour time format. This property is defined in the ETS in the "Display - General" parameter node. In the 12-hour time format, the display does not allow any distinction between a.m. and p.m.

Special display information

Programming mode is signalled by the text "Prog" on the display. If a valid application is already loaded into the device and the device is set back into Programming mode, Programming mode is signalled alternately by the text "Prog" and the displayed firmware version (e.g. "A1.00") in the display. If the device does not contain an application program - or contains the wrong one - the text "LEEr" appears. In the delivery state, the text "NEU" is shown in the display. The display shows the text "LOAd" during an active programming operation.

11.1.2 Display control

Change-over of the display

Up to 17 pieces of display information (actual temperature, setpoint temperature, outdoor temperature, any temperature) can be optionally displayed on the LC display of the device with the room temperature controller icons. The individual pieces of information are shown separately in the numeric display.

It is possible to switch between the information automatically after set times or, independently of this, in a controlled manner by pressing a button on the device:

– Change-over by time:
  If more than one piece of display information is configured in the ETS in the parameter node "Display - Module", then the display must be switched over during operation. The ETS parameter "Cyclical change" specifies the display time of a piece of information. The next piece of information is displayed when this time has elapsed. When the last piece of information has been reached, there is a changeover to the first piece of information.
– Change-over through button-press:
  In addition to the cyclical change, the indication can also be switched by pressing a button on the device. To do this it is possible to configure a button for the "Change in the display reading" function. This configuration is performed in the parameter block of the respective button. This function can be configured for any desired buttons on the room controller display compact module and optionally also for buttons on the extension module.
  When a button is pressed, depending on the button parameterisation either the next or the previous display information is called up in accordance with the cyclical change. With this setting the display information specified according to the configuration in the "Display - Module" parameter node can be switched directly.
  Alternatively it is also possible to call up a particular piece of information immediately independently of the display information of the cyclical change (e.g. display information "Recall display information 1"). It is not assumed here that the indication called up in this manner is in fact integrated into the cyclical change. After a piece of information is called up by pressing a button, the indication is retained until the time for the cyclical change has elapsed.

In the parameter node "Display -> Display – Module -> Display information *n*", it is also possible to set that no information is displayed using the parameter "Display information *n*". In this case, the normal depiction of the display is dark (only the designed button function icons are displayed). It is then only possible as necessary to call up individual display information by pressing a button using the button function "Change in the display reading". The indication called up in this manner then remains temporarily visible in the display depending on the time configured for the cyclical change.

The piece of display information last called up by the cyclical change or by a button press is overridden and overwritten in the display if the device is operated locally in another way (e.g. temporary setpoint temperature display in the case of setpoint shift in the menu level).

Backlighting

The display of the device has white backlighting that can be switched or dimmed. The function of the backlighting is specified in the "Control" parameter in the "Display - Module" parameter node in the ETS. The backlighting can be switched permanently on or off. In addition, event-controlled activation of the backlighting is possible by...

– pressing any desired operating element and activating the operating mode "Night ☾" on the internal room temperature controller,
– pressing any desired operating element and the normal or inverted value of a switching telegram via the 1-bit communication object "Backlighting On / Off",
– pressing any desired operating element and the value of a value telegram via the 1-byte communication object "Backlighting brightness". The lighting can be dimmed using the value.

If the lighting is switched on by pressing a operating element (rocker or button), the device switches the lighting off automatically when the switch-off time configured in the ETS elapses. The switch-off time is retriggered each time an operating element is actuated. If the lighting is to be switched on in "Night" operating mode, the lighting remains switched on continuously when night mode is active. Switching on by pressing a button or via the operating mode "Night" always takes place using the brightness value configured in the ETS or specified locally in the menu level.

When the backlighting is switched by the 1-bit communication object (alternatively to the 1-byte object), the lighting remains switched on continuously according to the switching value (not inverted: "0" = OFF / "1" = ON; inverted: "0" = ON" / "1" = OFF). Here the switch-on brightness is defined by the display brightness value configured in the ETS or specified locally in the menu level.

In the case of activation by the value object the lighting is dimmed in accordance with the received value ("1...100%") or actuated to the maximum ("100%"). The value "0%" switches the lighting off completely.

Lighting activation by pressing an operating element can be combined with switching or dimming via the corresponding objects. In this case the control via the communication objects has a higher priority. The lighting is switched on automatically by pressing an operating element, and is only switched off again when the switch-off time configured in the ETS elapses, if the lighting is to be switched off via the corresponding communication object (object value "OFF" or "0"). It is not possible to switch-off backlighting switched on by operation early using a bus telegram.

The brightness of the LCD backlighting in the switched-on state (always on, through button-press, night mode or 1-bit object) and the display contrast can be set locally on the device in the menu level . The brightness value set in the menu level is saved in the device in non-volatile memory, and overwrites the value last programmed using the ETS.
When the brightness value is set in the menu level, the following points must be noted in combination with the 1-byte brightness value object:

– In transition to the menu level, the lighting is switched on using the value last set via the value object. If the backlighting is controlled exclusively via the value object, the following applies: If the object value is 0...9 %, then the backlighting is controlled to 10% minimum brightness (initial value after commissioning) or to the value last selected in the menu level (5...100%). If the backlighting can also be switched on by pressing a button, the following applies: If the object value is 0...9 %, the backlighting is set to the last value programmed via the ETS or selected in the menu level (5...100 %).

– In the menu level, the menu item "Brightness" always offers the value from the ETS or the value last set using the buttons "+" or "-". If the menu item "Brightness" is selected, the device always works with the brightness value displayed in the menu level (a before activation of the object value received in the menu level is then discarded).
– If a brightness value is received while the menu level is active, then when the menu level is exited a decision is made whether the settings of the operating level are saved or not. During saving, the brightness value last received by the object is discarded and the value of the menu level is adopted. If no saving is performed, the object value last received is adopted as the new brightness value. In this case the adoption takes place in the configuration "Switching on the lighting by pressing a button and value object" only after the time for automatic switch-off has elapsed.

After a programming via the ETS or after a bus reset the value of the communication object of the backlighting is always "0", which means that the lighting is switched off.

Switching on the backlighting or dimming it up is performed immediately. Switching off or dimming down is performed gradually (soft OFF with fixed dimming time implemented).

In the un-programmed delivery state of the of the device (indication of the firmware version in the display) or during a programming process ("Prog" shown in the display), the brightness value of the backlighting is preset to the initial brightness (100 %).

11.1.3 Button function icons

Button function icons (only in the design ranges LS and CD!) can support the user of the device in the operation of button and rocker functions by visualising the button function. Up to eight button function icons can be configured in the ETS. Up to eight button function icons are displayed, irrespective of the device variant (2-gang or 4-gang). The button function icons 1 to 8 are each assigned to a fixed position in the display (see figure 50).

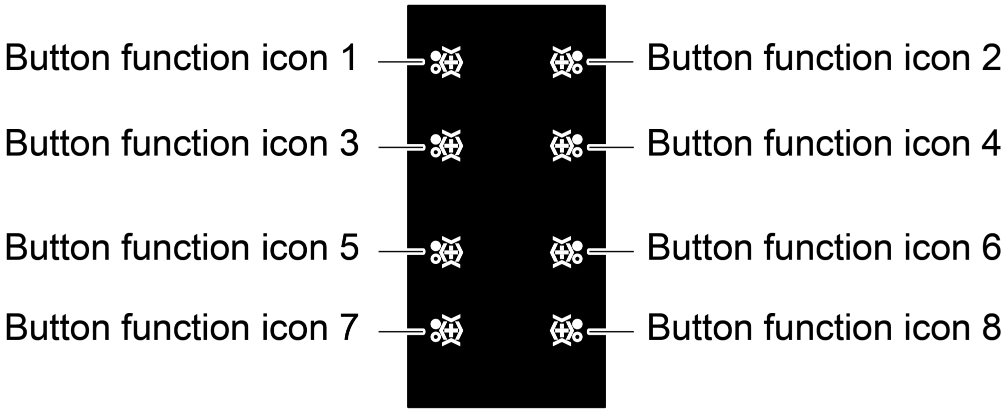

Figure 50: Arrangement of the button function icons

The button function icons are configured by making individual segments visible in the ETS. It is possible to select from the same segments for each button. The 9 available segments are listed on parameter pages "Icon 1" to "Icon 8". During project design, individual segments, as well as multiple segments, can be shown. Together, all the shown segments define the button function icon.

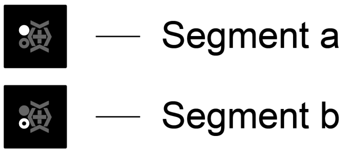

Figure 51: Button function icons: Segment a and b

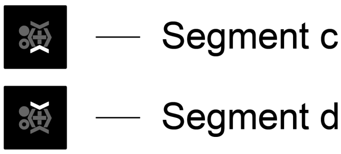

Figure 52: Button function icons: Segment c and d

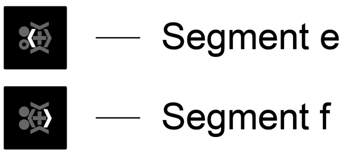

Figure 53: Button function icons: Segment e and f

Figure 54: Button function icons: Segment g, h and i

To activate an '+' icon, segments g, h and i can jointly be switched to visible.

The defined button function icons are shown statically on the display. No button function icon is displayed when all the segments on a "Icon *n*" parameter page are set to "Inactive". In this case, the appropriate item in the display remains empty.

With the 2-gang device variant, two button function icons are available for each button.

11.1.4 "Display" parameter group

Display -> Display - General

Temperature display	°C °F
The display can show temperature values in the formats °C and °F. This parameter decides in which format temperature values are shown on the display. Room temperature control and room temperature measurement always takes place with temperature values in the °C format. The room controller module converts the received temperature values into °F, if °F values are to be displayed.	

Time display	24 hours 12 hours
The time can be displayed in the 24h or 12h time format. In the 12h time format, the display does not allow any distinction between a.m. and p.m.	

Request time	Active Inactive
The device possesses an internal clock, set using a communication object. The internal calculation of the current time is primarily influenced by the scope of the internally planned functions and the resulting data traffic. This may cause particularly large time deviations. For this reason, the internal clock should be synchronised on a regular basis. The device will consider the internal time invalid for as long as no time telegram is received after a device reset, or if there has been no update for a day. In this case, an optional automatic time poll can take place. For this, the automatic time poll can be activated using the "Active" setting here. In so doing, if the time information is invalid, the device will request the time once only by sending a read telegram to the bus. The read request should the be confirmed by an other bus subscriber using an answer telegram.	

Request time with	Switching telegram value '1' Switching telegram value '0'
In order to request the time, the telegram polarity of the request telegram can be configured here.	

Temporary setpoint display	**Active** Inactive
Optionally, the setpoint of the respective current operating mode can be shown automatically in the display if a setpoint shift is performed using the buttons of the device ("Setpoint temperature shift" push-button function). The setpoint temperature is then displayed temporarily for 5 s in °C or °F, and overwrites the normal display (actual temperature, etc.). The setpoint display for a setpoint temperature shift is activated when this parameter is set to "Active". With the setting "Inactive" the temporary indication is inactive, meaning that in case of a setpoint shift only the line graphic of the display is activated, but the temperature value is not also displayed automatically. The temporary setpoint value display is only possible when controller is active or controller extension is active. Moreover, the displayed controller must be activated for the temporary setpoint display via the following parameter.	

Controller 1	**Active** Inactive
Temporary setpoint display for setpoint shift for controller 1	

Controller 2	**Active** Inactive
Temporary setpoint display for setpoint shift for controller 2.	

Menu level	Active **Inactive**
The menu level makes it possible to make various basic settings on the unit locally without using the ETS. In order to avoid the unintentional disruption of essential functions, access to the menu level can be prevented by setting this parameter to "Inactive". The setting "Active" allows access to the menu level. Then, the "Menu level" is shown in the ETS with additional parameters. If the menu level is enabled, full-surface operation of the TSM rocker 1 is not possible.	

Automatically exit	**Active** Inactive
This parameter can be used to configure the automatic exiting of the menu level. In the "Active" setting, the device leaves the menu level when no additional operation takes place after the last push-button operation within the "Switch-on time" configured in the ETS. With "Inactive", the menu level remains active until it is exited manually with the button combination or using the menu entries "OK" or "ESC".	

Switch-on time	10 s ... **30 s** ... 1 min, 59 s
This parameter specifies the time until automatic exiting of the menu level after no more buttons are pressed. This parameter is only visible if the parameter "Exit automatically" is set to "Active".	

Save changes	Active Inactive
For automatic exiting of the menu level, this parameter can be used to define whether the settings are saved or not.	

Save changes after manual exiting	Active Inactive
This parameter defines whether the settings are saved or not when the menu level is exited using the button combination.	

First menu item in menu level	Time Actual temperature via object Setpoint temperature via object Outdoor temperature via object Any temperature 1 Any temperature 2 Any temperature 3 Submenu Controller 1 Submenu Controller 2 Display settings
The menu entry that is shown as the first entry when the menu level is called up can be selected using this parameter. The sequence of the subsequent entries is fixed as shown in the parameter structure. The following parameter is displayed according to this parameter. The first menu item in the menu level cannot be hidden.	

Show time	Inactive Active
The current time can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", the time is not displayed in the menu level.	

Display actual temperature	Inactive Active
The actual temperature (room temperature) can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", the actual temperature is not displayed in the menu level.	

Display setpoint temperature	Inactive Active
The setpoint temperature can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", the setpoint temperature is not displayed in the menu level.	

Display outdoor temperature	Inactive Active
The outdoor temperature can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", the outdoor temperature is not displayed in the menu level.	

Display any temperature 1	Inactive Active
Any temperature 1 received via an object can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", any temperature 1 is not displayed in the menu level.	

Display any temperature 2	Inactive Active
Any temperature 2 received via an object can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", any temperature 2 is not displayed in the menu level.	

Display any temperature 3	Inactive Active
Any temperature 3 received via an object can optionally be displayed in the menu level ("Active" setting). With the setting "Inactive", any temperature 3 is not displayed in the menu level.	

Display Submenu Controller 1	Inactive Active
This parameter specifies whether the settings of the first controller are displayed in the menu level ("Active" setting). The settings of the first controller are the basic setpoint and the setpoint temperatures for Standby and Night mode for heating and cooling. With the setting "Inactive" the setpoint temperatures of the controller are not shown in the menu level, and thus cannot be changed, either. This parameter has no effect in a controller extension.	

Display Submenu Controller 2	Inactive Active
This parameter specifies whether the settings of the first controller are displayed in the menu level ("Active" setting). The settings of the first controller are the basic setpoint and the setpoint temperatures for Standby and Night mode for heating and cooling. With the setting "Inactive" the setpoint temperatures of the controller are not shown in the menu level, and thus cannot be changed, either. This parameter has no effect in a controller extension.	

Indicate display settings	**Inactive** Active
This parameter specifies whether the settings of the display are shown in the "Menu level" parameter node ("Active" setting). The parameters "Brightness", "Brightness reduction" and "Pixel test" in the parameter node "Display -> Display - General -> Submenu display" become available. In the "Inactive" setting, the "Display settings" parameter page is hidden. Accordingly, it is not possible to display or change the display brightness in the menu level. The pixel test is also not possible in this setting.	

The "Submenu controller .." is only visible if the menu level has been activated on the "Display - General" page and then the submenu of the corresponding controller has been activated.

i The configuration of these parameters must be adapted to the configuration of the corresponding room temperature controller in order to avoid incorrect displays. For example, it is essential to activate presence detection in the room thermostat in order for this to be shown on the display.

Display -> Display - General -> Submenu Controller 1 / Submenu Controller 2

Basic temperature / comfort temperature	Hidden Visible **Visible and changeable**
This temperature specifies for Controller 1 and Controller 2 whether the basic temperature can be changed in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting). With the setting "Hidden", the basic temperature is not displayed in the submenu and cannot be set. This parameter has no effect in a controller extension.	

Setpoint temperature, standby heating	Hidden Visible **Visible and changeable**
This temperature specifies for Controller 1 and Controller 2 whether the setpoint temperature for the Standby operating mode in the Heating operating mode can be changed in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting). With the setting "Hidden", the setpoint temperature is not displayed in the submenu and cannot be set. This parameter has no effect in a controller extension.	

Setpoint temperature, standby cooling	**Hidden** Visible Visible and changeable

This temperature specifies for Controller 1 and Controller 2 whether the setpoint temperature for the Standby operating mode in the Cooling operating mode can be changed in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", the setpoint temperature is not displayed in the submenu and cannot be set.
This parameter has no effect in a controller extension.

Setpoint temp. night heating	Hidden Visible **Visible and changeable**

This temperature specifies for Controller 1 and Controller 2 whether the setpoint temperature for the Night operation operating mode in the Heating operating mode can be changed in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", the setpoint temperature is not displayed in the submenu and cannot be set.
This parameter has no effect in a controller extension.

Setpoint temp. night cooling	**Hidden** Visible Visible and changeable

This temperature specifies for Controller 1 and Controller 2 whether the setpoint temperature for the Night operation operating mode in the Cooling operating mode can be changed in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", the setpoint temperature is not displayed in the submenu and cannot be set.
This parameter has no effect in a controller extension.

Presence detection	**Hidden** Visible Visible and changeable

This parameter specifies for Controller 1 and Controller 2 whether the presence detection can be set in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", it is not possible to set the presence mode in the submenu.
This parameter has no effect in a controller extension.

Setpoint shift	Hidden Visible Visible and changeable

This temperature specifies for Controller 1 and Controller 2 whether the setpoint shift can be set in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", it is not possible to set the setpoint shift in the submenu.
This parameter has no effect in a controller extension.

Operating mode	Hidden Visible Visible and changeable

This temperature specifies for Controller 1 and Controller 2 whether the operating mode can be set in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting).
With the setting "Hidden", it is not possible to set the operating mode in the submenu.
This parameter has no effect in a controller extension.

Fan controller	Hidden Visible Visible and changeable

This temperature specifies for Controller 1 and Controller 2 whether fan control is possible in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting). The menu item "Fan control" is actually only visible in the menu level if the fan control has been configured as present under "Room temperature control -> Controller general".
With the setting "Hidden", fan control is not possible in the menu level.
This parameter has no effect in a controller extension.

Actual-temperature	Hidden Visible

This temperature specifies for Controller 1 and Controller 2 whether the actual temperature is displayed in the submenu of the menu level ("Visible" setting).
With the setting "Hidden", the actual temperature is not displayed in the submenu.
This parameter has no effect in a controller extension.

Setpoint temperature	Hidden Visible

This temperature specifies for Controller 1 and Controller 2 whether the setpoint temperature is displayed in the submenu of the menu level ("Visible" setting).
With the setting "Hidden", the setpoint temperature is not displayed in the submenu.
This parameter has no effect in a controller extension.

Outdoor temperature	**Hidden** Visible
This temperature specifies for Controller 1 and Controller 2 whether the outdoor temperature is displayed in the submenu of the menu level ("Visible" setting). With the setting "Hidden", the outdoor temperature is not displayed in the submenu. This parameter has no effect in a controller extension.	

Any temperature 1	**Hidden** Visible
This parameter specifies for Controller 1 or Controller 2 whether any temperature 1 is displayed in the submenu of the menu level ("Visible" setting). With the setting "Hidden", any temperature 1 is not displayed in the submenu. This parameter has no effect in a controller extension.	

Any temperature 2	**Hidden** Visible
This parameter specifies for Controller 1 or Controller 2 whether any temperature 2 is displayed in the submenu of the menu level ("Visible" setting). With the setting "Hidden", any temperature 2 is not displayed in the submenu. This parameter has no effect in a controller extension.	

Any temperature 3	**Hidden** Visible
This parameter specifies for Controller 1 or Controller 2 whether any temperature 3 is displayed in the submenu of the menu level ("Visible" setting). With the setting "Hidden", any temperature 2 is not displayed in the submenu. This parameter has no effect in a controller extension.	

"Submenu display" is only visible if the menu level has been activated on the "Display - General" page.

Display -> Display - General -> Submenu display

Brightness	Hidden Visible **Visible and changeable**
This temperature specifies whether the display brightness can be set in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting). With the setting "Hidden", the display brightness is not displayed in the submenu and cannot be set.	

Brightness reduction	Hidden **Visible** Visible and changeable
This parameter specifies whether a reduced display brightness can be set in the submenu of the menu level (setting "Visible and changeable") or whether it should only be visible ("Visible" setting). With the setting "Hidden", the reduced display brightness is not displayed in the submenu and cannot be set.	

Pixel test	Hidden **Visible**
This parameter specifies whether the pixel test of the display can be recalled in the submenu of the menu level ("Visible" setting). With the setting "Hidden", the pixel test cannot be recalled in the menu level.	

Display -> Display - module

Control	Always Off Always On **Switch on through button-press** Switch on in night mode Switch on through button-press or Night mode Switch on through switching object Switch on through inverted switching object Switch on through button-press or switching object Switch on through button-press or inv. switching object Switch on through value object (0%...100%) Switch on through button-press or value object
The display can be permanently switched on or off or alternatively be switched according to events. If the display is switched on by pressing a operating element (rocker or button), the device switches the display off automatically when the switch-off time configured in the ETS elapses. The switch-off time is retriggered each time an operating element is actuated. If the lighting is to be switched on in "Night" operating mode, the lighting remains switched on continuously when night mode is active. Switching on by pressing a button or via the operating mode "Night" always takes place using the brightness value configured in the ETS or specified locally in the menu level. When the display is switched by the 1-bit communication object (alternatively to the 1-byte object), the lighting remains switched on continuously according to the switching value (not inverted: "0" = OFF / "1" = ON; inverted: "0" = ON" / "1" = OFF). Here the switch-on brightness is defined by the display brightness value configured in the ETS or specified locally in the menu level. In the case of activation by the value object the display is dimmed in accordance with the received value ("1...100%") or actuated to the maximum ("100%"). The value "0" switches the display off completely. Display activation by pressing an operating element can be combined with switching or dimming via the corresponding objects. In this case the control via the communication objects has a higher priority. The lighting is switched on automatically by pressing an operating element, and is only switched off again when the switch-off time configured in the ETS elapses, if the lighting is to be switched off via the corresponding communication object (object value "OFF" or "0"). The switch-off can then only take place using a switch-off telegram in accordance with the normal or inverted telegram polarity or via a value = "0". It is not possible to switch-off displays switched on by operation early using a bus telegram.	

Automatic switch-off after	0 ... **15 s** ... 60 s ... 60 min
The display is switched off automatically after the time set here, if it has been switched on by a button-press. This parameter is only visible when the backlighting can be switched on by button-press.	

Controller night operation (RNST)	**1** 2 1 or 2 1 and 2
This parameter is only visible when the backlighting is switched on by night operation. In the "1" setting, the operating mode of the first controller decides on the status of the backlighting. In the "2" setting, the operating mode of the second controller decides on the status of the backlighting. In the "1 or 2" setting, the backlighting of the display is switched on as soon as one of the two controllers switches to the Night operating mode. In the "1 and 2" setting, the backlighting of the display is switched on when both controllers are in the Night operating mode.	

Overwrite brightness settings on the device during ETS download	**Active** Inactive
If the parameter is active, the brightness settings in the device are overwritten with the brightness settings from the ETS with each programming. The brightness settings refer to normal and reduced brightness. If the parameter is switched to inactive, the brightness settings in the device are retained. The reduced brightness setting is only visible if "Brightness reduction" is activated in the "Configuration TSM".	

Brightness	10 ... **70** ... 100
This parameter defines the brightness of the LCD backlighting. The value configured here can be overwritten after commissioning of the device locally in the menu level.	

Reduced brightness	10 ... **30** ... 100
This parameter defines the reduced brightness of the LCD backlighting. The reduced brightness setting is only visible if "Brightness reduction" is activated in the "Configuration TSM".	

Increase brightness for 30 seconds	**Active** Inactive
Here, the brightness increase can be enabled for 30 seconds after a button has been actuated. The TSM then switches the brightness of the display to normal brightness.	

Number of pieces of display information	1 ... 17
In addition to the button function icons, it is possible to use the numeric display to show up to 17 display functions in the display. This means that is possible to display the setpoint temperature, the actual temperature, the outdoor temperature and any temperatures 1-3. The temperatures can also be displayed in combination with the controller icons. It is possible to configure how much of this information is actually shown in the display using this parameter in the ETS. For each piece of display information, additional parameter nodes are then shown in the ETS.	

Cyclic change	1...10...60 s
This parameter specifies after how long a changeover of display information takes place on the display. There is no cyclical change of the display information, if a piece of display information is recalled via the communication object.	

Display information via object	No recall Switching object (1 bit) Value object (1-byte)
This parameter specifies whether a changeover of display information takes place on the display via a communication object. "No recall" setting: There is only a cyclical change of the display information. "Switching object (1 bit)" setting: The parameter "Switching object display information" and the communication object "Recall fixed display information" are enabled. The previously designed display information is shown on the display for the period during which the value of the object is "1". There is no cyclical change of the display information. "Value object 1 byte" setting: The communication object "Recall variable display information" is enabled. The previously designed display information, corresponding to the value of the object, is shown on the display for the period during which the value of the object is "1", "2", ..., "17". There is no cyclical change of the display information. The cyclical switchover of the display information begins again when the communication object receives a "0" telegram via the KNX.	

Display information	Recall display information 1 Recall display information 2 ... Recall display information 17
The communication object "Recall fixed display information" recalls the display information set here when it is written with a "1" telegram. This parameter is only visible with "Switching object (1 bit)	

Button function icons	Active **Inactive**
In the display, a button function icon can be assigned to each button. This parameter enables the parameter page "Button function icons" for project design of the button function icons. Button function icons are only available in the CD and LS series!	

Display -> Display - Module -> Display information -> Display *n*

Display information *n*	No indication Time Actual temperature (via object) Setpoint temperature (via object) Outdoor temperature (via object) Any temperature 1 Any temperature 2 Any temperature 3 Controller 1: Actual temperature **Controller 1: Setpoint temperature** Controller 1: Outdoor temperature Controller 2: Actual temperature Controller 2: Setpoint temperature Controller 2: Outdoor temperature
Here, it is possible to select which piece of information is to be Indicated on the display.	

Show controller symbols	No indication **Controller 1** Controller 2
Here, you can select whether a corresponding controller icon should also be shown on the display. The possible selection values are based on the selected display information. For example, if the display information for a temperature of controller 1 is set, only the icon of controller 1 or no icon can be displayed.	

In cyclical changeover	**Active** Inactive
This parameter decides whether the display information is also to be recalled in the cyclical changeover of the display information. "Active" setting: The display information is recalled in the cyclical changeover. "Inactive" setting: The display information is not recalled in the cyclical changeover. It can only be recalled via the communication object. For display information item 1, this parameter is permanently set to "Active". Accordingly, the cyclical changeover of the display information begins with display information item 1.	

Display -> Display - Module ->Button function icons -> Icon *n*

Preview on/off	Graphic in the application program

Segment a	**Inactive** Active
The parameter shows Segment a (see graphic in the application program).	

Segment b	**Inactive** Active
The parameter shows Segment b (see graphic in the application program).	

Preview up/down	Graphic in the application program

Segment c	**Inactive** Active
The parameter shows Segment c (see graphic in the application program).	

Segment d	**Inactive** Active
The parameter shows Segment d (see graphic in the application program).	

Icon preview Left/Right	Graphic in the application program

Segment e	**Inactive** Active
The parameter shows Segment e (see graphic in the application program).	

Segment f	**Inactive** Active
The parameter shows Segment f (see graphic in the application program).	

Preview increase/decrease	Graphic in the application program

Segment g	Inactive Active
The parameter shows Segment g (see graphic in the application program).	

Segment h	Inactive Active
The parameter shows Segment h (see graphic in the application program).	

Segment i	Inactive Active
The parameter shows Segment i (see graphic in the application program).	

11.1.5 "Display" objects

Function	Name	Type	DPT	Flag
Backlighting On/Off	Display - Input	1-bit	1,001	C, -, W, -, U
1-bit object for switching the backlighting of the LC display (polarity configurable).				

Function	Name	Type	DPT	Flag
Backlighting brightness	Display - Input	1-byte	5,001	C, -, W, -, U
1-byte object for presetting a brightness for the backlighting of the LC display.				

Function	Name	Type	DPT	Flag
Time	Display - Input	3-byte	10,001	C, -, W, T, U
3-byte object for receiving the current time via the bus. The time can be shown on the display (parameter-dependent).				

Function	Name	Type	DPT	Flag
Request time	Display - Output	1-bit	1,001	C, -, -, T, U
1-bit object to request the current time via the bus. The time can be shown on the display (parameter-dependent).				

Function	Name	Type	DPT	Flag
Actual-temperature	Display - Input	2-byte	9,001	C, -, W, -, U
2-byte object for receiving an actual temperature. The actual temperature can be shown on the display.				

Function	Name	Type	DPT	Flag
Setpoint temperature	Display - Input	2-byte	9,001	C, -, W, -, U
2-byte object for receiving a setpoint temperature. The setpoint temperature can be shown on the display.				

Function	Name	Type	DPT	Flag
Outdoor temperature	Display - Input	2-byte	9,001	C, -, W, -, U
2-byte object for receiving an outdoor temperature. The outdoor temperature can be shown on the display.				

Function	Name	Type	DPT	Flag
Any temperature (1-3)	Display - Input	2-byte	9,001	C, -, W, -, U
2-byte objects for receiving any temperature values. The temperatures can be shown on the display.				

Function	Name	Type	DPT	Flag
Recall fixed display information	Display - Input	1-bit	1,001	C, -, W, -, U
1-bit object, using which previously configured display information is recalled on the display.				

Function	Name	Type	DPT	Flag
Recall variable display information	Display - Input	1-byte	5,010	C, -, W, -, U
1-byte object, using which the up to 17 items of configurable display information can be recalled. "1" telegram: Recall display 1 "2" telegram: Recall display 2 ... "17" telegram: Recall display 17				

Function	Name	Type	DPT	Flag
Cycl. disable change of display information	Display - Input	1-bit	1,001	C, -, W, -, U
1-bit object, using which the cyclical change of the display information can be disabled. "1" telegram: Disabling active "0" telegram: Disabling inactive The most recently set display information remains visible in the display if the cyclical change of display information is disabled. As soon as disabling is removed, the display information are shown cyclically in the display.				

11.2 Room temperature controller function

The device unites two independent room temperature controllers (Controller 1 and Controller 2). Each controller is an independent function section of the device and has its own parameter and object range in the ETS. Therefore, the room temperature controllers can be switched on or off, irrespective of the pushbutton sensor function, or configured as a controller extension.

A controller can be used for single-room temperature control. Depending on the operating mode, current temperature setpoint and room temperature, command values for heating or cooling control and fan controller can be sent to the KNX. These command values are usually then converted by a suitable KNX actuator, e.g. heating or switching actuators or directly by bus-compatible actuating drives, evaluated and converted to physical variables for air conditioning control.

The controllers of the device can either work as a main controller or as a controller extension. As the main controller, the room temperature controller function is fully switched on and the control algorithm activated. Only the main controller transmits control value telegrams. A controller extension itself is not involved in the temperature regulating process. With it, the user can operate the single-room controller, i.e. the main controller from different places in the room. In this way, any number of operating extensions can be set up.

In this chapter, the functions of the room temperature controller are described as the main controller.

i The following chapters on room temperature control apply for both Controller 1 and Controller 2. The functions of both controllers are identical.

11.2.1 Operating modes and operating mode change-over

Introduction

The room temperature controller distinguishes between two different operating modes. The operating modes specify whether you want the controller to use its command value to trigger heating systems ("heating" single operating mode) or cooling systems ("cooling" single operating mode). You can also activate mixed operation, with the controller being capable of changing over between "Heating" and "Cooling" either automatically or, alternatively, controlled by a communication object.
In addition, you can establish two-level control operation to control an additional heating or cooling unit. For two-level feedback control, separate command values will be calculated as a function of the temperature deviation between the setpoint and the actual value and transmitted to the bus for the basic and additional levels. The "Operating mode" parameter in the "Room temperature controller ... -> RTC .. - General" specifies the operating mode and, if necessary, enables the additional level(s).

"Heating" or "cooling" single operating modes

In the single "Heating" or "Cooling" operating modes without any additional level, the controller will always work with one command value and, alternatively, when the additional level is enabled, it will use two command value in the configured operating mode. Depending on the room temperature determined and on the specified setpoint temperatures of the operating modes, the room temperature controller will automatically decide whether heating or cooling energy is required and calculates the command value for the heating or cooling system.

Heating/cooling message

Depending on the set operating mode, separate objects can be used to indicate whether the controller is currently demanding heating or cooling energy and is thus actively heating or cooling. As long as the heating command value is > "0", a "1" telegram will be transmitted through the "Heating" signal object. The signal telegram is only reset when the command value is "0" ("0" telegram is transmitted). The same applies to the signal object for cooling.

The signal objects can be enabled by the "Heating status object" or "Cooling status object" parameters in the parameter branch "Room temperature controller .. -> RTC .. - General -> Status". The control algorithm controls the signal objects. Please note that the command value is recalculated every 30 s, followed by an updating of the signal objects.

"Heating and cooling" mixed operating mode

In the "Heating and cooling" mixed operating mode, the controller is capable of triggering heating and cooling systems. In this connection, you can set the change-over behaviour of the operating modes...

– Parameter "Heating/cooling switchover" in the parameter branch "Room temperature controller .. -> RTR ..- General" is set to "automatic via RTR".
  In this case, a heating or cooling mode will be automatically activated, depending on the room temperature determined and on the given temperature basic

setpoint, or on the deadband, respectively. If the room temperature is within the preset deadband neither heating nor cooling will take place (both command values = "0"). If the room temperature is higher than the cooling temperature setpoint cooling will take place. If the room temperature is lower than the cooling temperature setpoint heating will take place.
When the operating mode is switched over automatically, the information can be actively sent on the bus via the object "Heating/cooling operating mode - Status" to indicate whether the controller is working in heating mode ("1" telegram) or in cooling mode ("0" telegram). In this case, a telegram will be transmitted immediately on changing from heating to cooling (object value = "0") or from cooling to heating (object value = "1"), respectively.
The "Cyclical transmission" parameter enables cyclical transmission (factor setting > "0 min") and specifies the cycle time.

i With an automatic operating mode change-over, it should be noted that under certain circumstances there will be continuous change-over between heating and cooling if the deadband is too small. For this reason, you should, if possible, not set the deadband (temperature difference between the setpoint temperatures for the comfort heating and cooling modes) below the default value (2 K).

– Parameter "Heating/cooling switchover" in the parameter branch "Room temperature controller -> RTC - General" set to "via object".
In this case, the operating mode is controlled via the "Heating/cooling operating mode" object, regardless of the deadband. This type of change-over can, for example, become necessary if both heating and cooling should be carried out through a one-pipe system (heating and cooling system). For this, the temperature of the medium in the single-pipe system must be changed via the system control. Afterwards the heating/cooling operating mode is set via the object (often the single-pipe system uses cold water for cooling during the summer, hot water for heating during the winter).
The "Heating/cooling operating mode" object has the following polarities: "1": heating; "0": cooling. After a reset, the object value will be "0", and the "Operating mode after reset" set in the ETS will be activated. You can use the "Heating/cooling operating mode after reset" parameter to set which mode you want to activate after a reset. For the "Heating" or "Cooling" settings, the controller will activate the configured heating/cooling operating mode immediately after the initialisation phase. In case of parameterisation "Operating mode before reset" the operating mode which was selected before the reset will be activated.
If a switchover is made through the operating mode object, the operating mode will first be changed into the one specified after a reset. A change-over to the other operating mode will only take place after the device receives an object update, if necessary.

It is not possible to heat and cool at the same time (command value > "0"). Only for PWM, a short-time 'variable overlapping' could occur during the transition between heating and cooling, due to the matching of the variable at the end of a time cycle. However, such overlapping will be corrected at the end of a PWM time cycle.

Setpoint temperatures can be specified for each operating mode in the ETS as part of configuration. It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint setting) or relatively (derivation from basic setpoint temperature). With absolute setpoint setting there is no basic setpoint temperature and also no deadband in the mixed "Heating and cooling" operating mode (if necessary also with additional level). Consequently, the room temperature controller cannot control the switchover of the operating mode automatically, which is why, in this configuration, the setting for the parameter "Heating/cooling switchover" is fixed in the ETS to "via object".

11.2.2 Control algorithms and calculation of command values

Introduction

To facilitate convenient temperature control in living or business spaces a specific control algorithm which controls the installed heating or cooling systems is required. Taking account of the preset temperature setpoints and the actual room temperature, the controller thus determines command values which trigger the heating or the cooling system. The control system (control circuit) consists of a room temperature controller, a valve drive or switch actuator (when ETD electrothermal drives are used), the actual heating or cooling element (e.g. radiator or cooling ceiling) and of the room. This results in a controlled system (see figure 55).

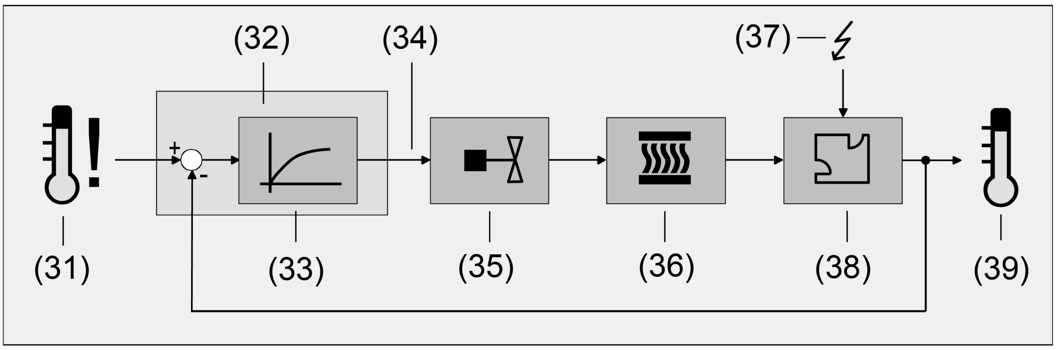

Figure 55: Controlled system of single-room temperature control

(31) Setpoint temperature specification
(32) Room temperature controller
(33) Control algorithm
(34) Command value
(35) Valve control (valve drive, ETD, heating actuator, ...)
(36) Heat / cold exchanger (radiator, cooling ceiling, FanCoil, ...)
(37) Fault variable (sunlight penetration, outdoor temperature, illumination systems, ...)
(38) Room
(39) Actual temperature (room temperature)

The controller measures the actual temperature (39) and compares it with the given setpoint temperature (31). With the aid of the selected control algorithm (34), the command value (35) is then calculated from the difference between the actual and the setpoint temperature. The command value controls valves or fans for heating or cooling systems (35), meaning that heating or cooling energy in the heat or cold exchangers (36) is passed into the room (38).
Regular readjustment of the command value means that the controller is able to compensate for setpoint / actual temperature differences caused by external influences (37) in the control circuit. In addition, the flow temperature of the heating or cooling circuit influences the control system which necessitates adaptations of the variable.

The room temperature controller facilitates either proportional/integral (PI) feedback control as a continuously working or switching option, or, alternatively, switching 2-point feedback control. In some practical cases, it can become necessary to use more than one control algorithm. For example, in bigger systems using floor heating, one control circuit which solely triggers the floor heating can be used to keep the latter at a constant temperature. The radiators on the wall, and possibly even in a side area of the room, will be controlled separately by an additional level with its own control algorithm. In such cases, distinction must be made between the different types of control, as floor heating systems, in most cases, require control parameters which are different to those of radiators on the wall, for example. It is possible to configure up to four independent control algorithms in two-level heating and cooling operation.

The command values calculated by the control algorithm are output via the "Heating command value" or "Cooling command value" communication objects. Depending on the control algorithm selected for the heating and/or cooling mode, the format of the command value objects is, among other things, also specified. In this way, 1-bit or 1-byte command value objects can be created. The control algorithm is specified by the parameters "Type of control" in the parameter branch "Room temperature controller .. -> RTC - General" and, if necessary, also with a distinction of the basic and additional levels.

Continuous PI control

PI control is an algorithm which consists of a proportional part and an integral part. Through the combination of these control properties, you can obtain room temperature control as quickly and precisely as possible without or only with low deviations. When you use this algorithm, the room temperature controller will calculate a new continuous command value in cycles of 30 seconds and send it to the bus via a 1-byte value object if the calculated command value has changed by a specified percentage. The parameter "On change by (0 = inactive)" in the parameter branch "Room temperature controller ..-> RTC .. - General -> Command value output" specifies the change interval in percent.

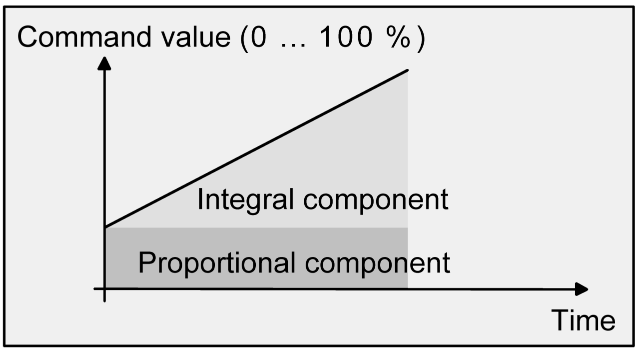

Figure 56: Continuous PI control

An additional heating or cooling stage as PI control works in the same way as the PI control of the basic stage, with the exception that the setpoint will shift, taking account of the parameterized step width.

Switching PI control

With this type of feedback control, the room temperature will also be kept constant by the PI control algorithm. Taking the mean value for a given time, the same behaviour of the control system will result as you would obtain with a continuous controller. The difference compared with continuous feedback control is only the way how the command value is output. The command value calculated by the algorithm in cycles of every 30 seconds is internally converted into a pulse-width-modulated (PWM) command value signal and sent to the bus via a 1-bit switching object after the cycle time has elapsed. Taking into account the cycle time settable using the parameter "PWM cycle time" in the parameter branch "Room temperature controller .. –> RTC .. - General -> Command value output" parameter branch.
A shift of the mean value, and thus a change in the heating capacity, can be obtained by changing the duty factor of the switch-on and switch-off pulses of the command value signal. The duty factor will be adapted by the regulator only at the end of a time period, depending on the variable calculated. This applies to any change of the command value, regardless of what the ratio is by which the command value changes (the "Automatic transmission on change by…" and "Cycle time for automatic transmission..." parameters will have no function in this case).
Each command value calculated last during an active time period will be converted. Even after you have changed the setpoint temperature, for example, by switching over the operating mode, the command value will still be adapted after the end of an active cycle time. The diagram below shows the command value switching signal output according to the internally calculated command value (first of all, a command value of 30 %, then of 50 %, with the command value output not being inverted).

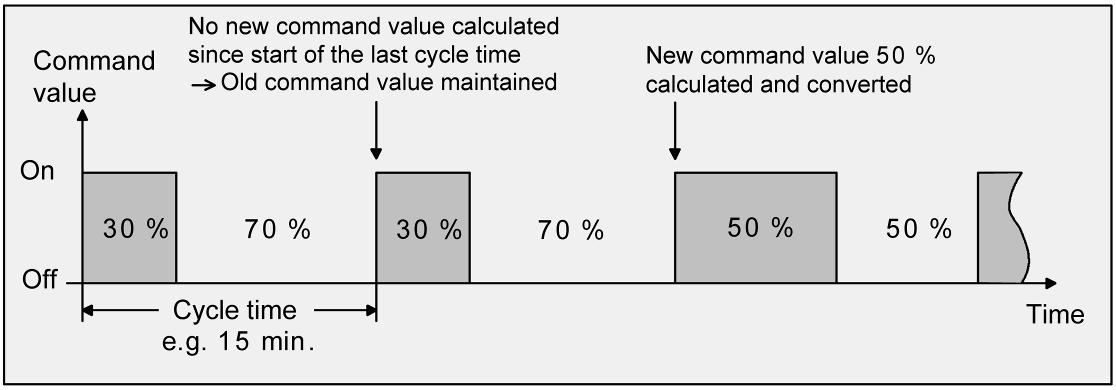

Figure 57: Switching PI control

For a command value of 0% (permanently off) or of 100% (permanently on), a command value telegram corresponding to the command value ("0" or "1") will always be sent after a cycle time has elapsed.
For switching PI control, the controller will always use continuous command values for internal calculation. Such continuous values can additionally be sent to the bus via a separate 1-byte value object, for example, as status information for visualisation purposes (if necessary, also separately for the additional levels). The status value objects will be updated at the same time as the command value is output and will only take place after the configured cycle time has elapsed. The parameters "On change by (0 = inactive)" and "Cyclical (0 = inactive)" have no function here. An additional heating or cooling stage as switching PI control works in the same way as the

PI control of the basic stage, with the exception that the setpoint will shift, taking account of the parameterised step width. All PWM control options will use the same cycle time.

Cycle time

The pulse-width-modulated command values are mainly used for activating electrothermal drives (ETD). In this connection, the room temperature controller sends the switching command value telegrams to a switch actuator equipped with semiconductor switching elements to which the drives are connected (e.g. heating actuator or room actuator). By setting the cycle time of the PWM signal on the controller, you can adapt the feedback control to the drives used. The cycle time sets the switching frequency of the PWM signal and allows adaptation to the adjusting cycle times of the valve drives used (the adjusting time it takes the drive to bring the valve from its completely closed to its completely opened position). In addition to the adjusting cycle time, take account of the dead time (the time in which the valve drives do not show any response when being switched on or off). If different actuators with different adjusting cycle times are used, take account of the longest of the times. Always note the information given by the manufacturers of the actuators.

During cycle time configuration, a distinction can always be made between two cases:

Case 1: Cycle time > 2 x adjusting cycle time of the electrothermal drives used (ETA)

– In this case, the switch-on or switch-off times of the PWM signal are long enough for the actuators to have sufficient time to fully open or fully close within a given time period.
– Advantages:
  The desired mean value for the command value and thus for the required room temperature will be set relatively precisely, even for several actuators triggered at the same time.
– Disadvantages:
  It should be noted, that, due to the full valve lift to be continuously 'swept', the life expectancy of the actuators can diminish. For very long cycle times (> 15 minutes) with less sluggishness in the system, the heat emission into the room, for example, in the vicinity of the radiators, can possibly be non-uniform and be found disturbing.

ℹ This setting is recommended for sluggish heating systems (such as underfloor heating).

ℹ Even for a bigger number of triggered actuators, maybe of different types, this setting can be recommended to be able to obtain a better mean value of the adjusting travels of the valves.

Case 2: Cycle time < adjusting cycle time of the electrothermal drives used (ETA)

– In this case, the switch-on or switch-off times of the PWM signal are too short for the actuators to have enough time to fully open or fully close within a given period.

- Advantages:
  This setting ensures continuous water flow through the radiators, thus facilitating uniform heat emission into the room.
  If only one valve drive is triggered the controller can continuously adapt the command value to compensate the mean value shift caused by the short cycle time, thus setting the desired room temperature.
- Disadvantages:
  If more than one drive is triggered at the same time the desired mean value will become the command value, which will result in a very poor adjustment of the required room temperature, or in adjustment of the latter with major deviations, respectively.
  The continuous flow of water through the valve, and thus the continuous heating of the drives causes changes to the dead times of the drives during the opening and closing phase. The short cycle time and the dead times means that the required command value (mean value) is only set with a possibly large deviation. For the room temperature to be regulated constantly after a set time, the controller must continually adjust the command value to compensate for the mean value shift caused by the short cycle time. Usually, the control algorithm implemented in the controller (PI control) ensures that control deviations are compensated.

i This setting is recommended for quick-reaction heating systems (such as surface radiators).

2-point feedback control

2-point feedback control represents a very simple temperature control. For this type of feedback control, two hysteresis temperature values are set. The actuators are triggered by the controller via switch-on and switch-off command value commands (1-bit type). A constant command value is not calculated for this type of control.
The room temperature is also evaluated by this type of control in cycles every 30 seconds. Thus the command values change, if required, only at these times. The disadvantage of a continuously varying temperature as a result of this feedback control option is in contrast with the advantage of this very simple 2-point room temperature control. For this reason, quick-reaction heating or cooling systems should not be triggered by a 2-point feedback control system, for this can lead to very high overshooting of the temperature, thus resulting in loss of comfort.

i When presetting the hysteresis limiting values, you should distinguish between the operating modes.

"Heating" or "cooling" single operating modes:

In heating mode, the controller will turn on the heating when the room temperature has fallen below a preset limit. In heating mode, the feedback control will only turn off the heating once a preset temperature limit has been exceeded.
In cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset limit. The control system will only turn off the cooling system once the temperature has fallen below a preset limit. In this connection, the

command value "1" or "0" will be output, depending on the switching status, if the temperature exceeds or falls below the hysteresis limits.
The hysteresis limits of both operating modes can be configured in the ETS.

It has to be pointed out that the message objects for heating and cooling will become active as soon as the temperature falls short of the temperature setpoint of the active operating mode in case of heating or exceeds the temperature setpoint in case of cooling. In this case the hysteresis is not being considered.

The following two images each show a 2-point feedback control for the individual operating modes "Heating" (see figure 58) or "Cooling" (see figure 59). The images take two temperature setpoints, one-stage heating or cooling and non-inverted command value output.

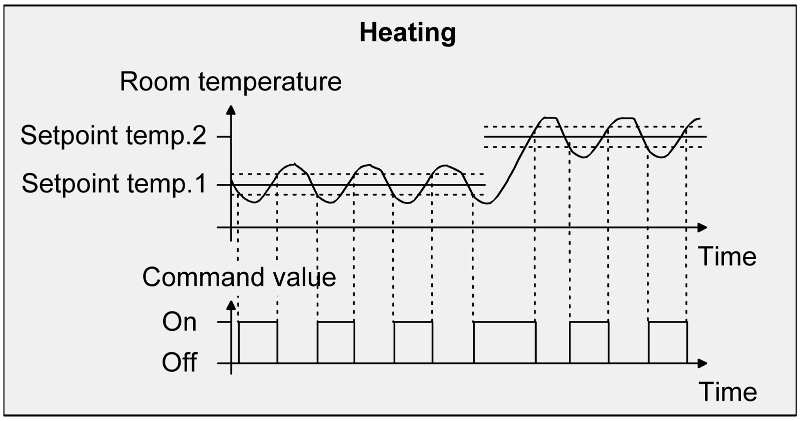

Figure 58: 2-point feedback control for the single "Heating" operating mode

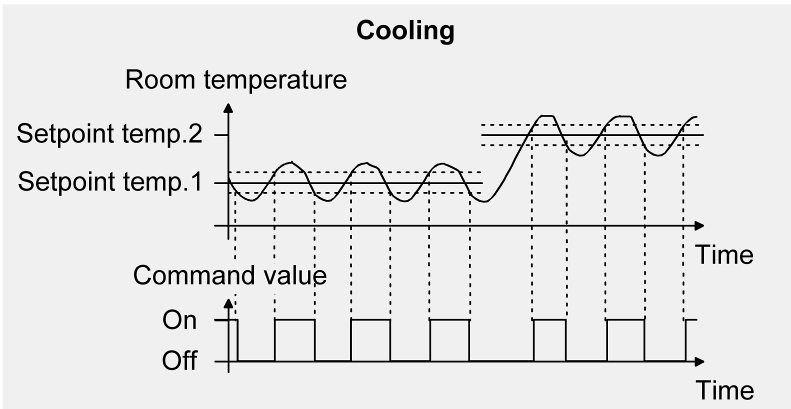

Figure 59: 2-point feedback control for the single "Cooling" operating mode

An additional 2-point feedback control heating or cooling level works exactly the same as the 2-point feedback control of the basic level. The difference is that the setpoint and the hysteresis values will shift by taking into account the configured level offset.

"Heating and cooling" mixed operating mode:

In mixed operation, a distinction is made whether the change-over between heating and cooling is to be effected automatically or in a controlled way through the object.

– With automatic operating mode change-over, in the heating mode the controller will turn on the heating when the room temperature has fallen below a preset hysteresis limit. In this case, as soon as the room temperature exceeds the setpoint of the current operating mode, the feedback control will turn off the heating in the heating mode. In the same way, in cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset hysteresis limit. As soon as the room temperature falls below the setpoint of the current operating mode, the feedback control will turn off the cooling system in the cooling mode. Thus, in mixed operation, there is no upper hysteresis limit for heating or no lower one for cooling, respectively, for these values would be in the deadband. Within the deadband, neither heating nor cooling will take place.
– With an operating mode switchover via the object, in heating mode, the controller will turn on the heating when the room temperature has fallen below a preset hysteresis limit. The feedback control will only turn off the heating in the heating mode once the preset upper hysteresis limit has been exceeded. In the same way, in cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset hysteresis limit. The feedback control will only turn off the cooling system in the cooling mode once the temperature has fallen below the preset lower hysteresis limit. As with the individual operating modes of heating or cooling, there are two hysteresis limits per operating mode. Although there is a deadband for the calculation of the temperature setpoints for cooling, it has no influence on the calculation of the two-point control value, as the operating mode is switched over manually through the corresponding object. Within the hysteresis spans, it thus will be possible to request heating or cooling energy for temperature values that are located within the deadband.

The following two images show 2-point feedback control for the mixed operating mode "Heating and cooling", distinguishing between heating mode (see figure 60) and cooling mode (see figure 61). The images take two temperature setpoints, a non-inverted command value output and an automatic operating mode change-over. When the operating mode is switched over via the object, an upper hysteresis for heating and a lower hysteresis for cooling can be configured.

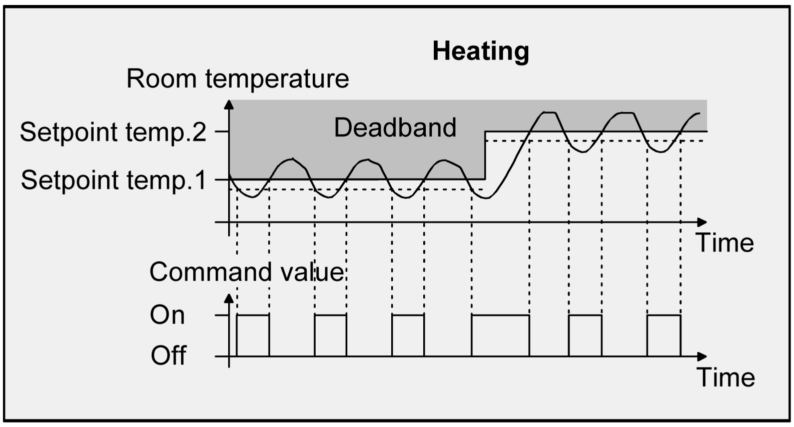

Figure 60: 2-point feedback control for mixed "Heating and cooling" mode with active heating mode

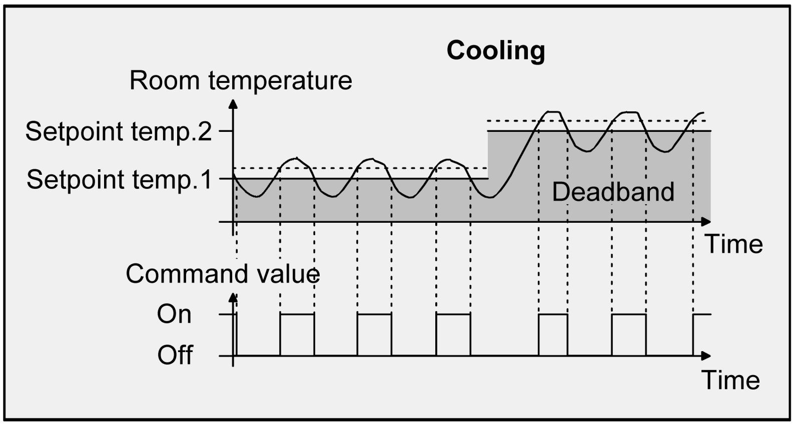

Figure 61: 2-point feedback control for mixed "Heating and cooling" mode with active cooling operation

The command value "1" or "0" will be output, depending on the switching status, if the temperature exceeds or falls below the hysteresis limits or the setpoints.

It has to be pointed out that the message objects for heating and cooling will become active as soon as the temperature falls short of the temperature setpoint of the active operating mode in case of heating or exceeds the temperature setpoint in case of cooling. In this case the hysteresis is not being considered.

An additional 2-point feedback control heating or cooling level works exactly the same as the 2-point feedback control of the basic level. The difference is that the set-point and the hysteresis values will shift by taking into account the configured level offset.

11.2.3 Adapting the control algorithms

Adapting the PI control

There are several systems available, which may heat or cool a room. One option is to uniformly heat or cool the surroundings via heat transfer media (preferably water or oil) in connection with room air convection. Such systems are used, for example, with wall mounted heaters, underfloor heating or cooling ceilings.
Alternatively or additionally forced air systems may heat or cool rooms. In most cases such systems are electrical forced hot air systems, forced cool air systems or refrigerating compressors with fan. Due to the direct heating of the room air such heating and cooling systems work quite swiftly.

The control parameters need to be adjusted so that the PI control algorithm may efficiently control all common heating and cooling systems thus making the room temperature control work as fast as possible and without deviation. Certain factors can be adjusted with a PI control that can influence the control behaviour quite significantly at times. For this reason, the room temperature controller can be set to predefined ‘experience values’ for the most common heating and cooling systems. In case the selection of a corresponding heating or cooling system does not yield a satisfactory result with the default values, the adaptation can optionally be optimised using control parameters.
Predefined control parameters for the heating or cooling stage and, if applicable, also for the additional stages are adjusted via the "type of heating" or "type of cooling" parameters. These fixed values correspond to the practical values of a properly planned and executed air conditioning system and will result in an ideal behaviour of the temperature control. The heating and cooling types shown in the following tables can be set for heating and cooling operation.

The following table shows predefined control parameters and recommended control types for heating systems:

Type of heating	Proportional range (preset)	Reset time (preset)	Recommended PI control type	Recommended PWM cycle time
Heat water heating	1 Kelvin	830 minutes	Continuous / PWM	15 min.
Underfloor heating	1.5 Kelvin	1000 minutes	PWM	15-20 min.
Electrical heating	1 Kelvin	830 minutes	PWM	10-15 min.
Fan coil unit	1 Kelvin	500 minutes	Continuous	---
Split unit (split climate control unit)	1 Kelvin	500 minutes	PWM	10-15 min.

The following table shows predefined control parameters and recommended control types for cooling systems:

Cooling type	Proportional range (preset)	Reset time (preset)	Recommended PI control type	Recommended PWM cycle time
Cooling ceiling	1 Kelvin	830 minutes	PWM	15-20 min.
Fan coil unit	1 Kelvin	500 minutes	Continuous	---
Split unit (split climate control unit)	1 Kelvin	500 minutes	PWM	10-15 min.
Underfloor cooling	1.5 Kelvin	1000 minutes	PWM	15-20 min.

If the "Type of heating" or "Type of cooling" parameters are set to "Via control parameters" it will be possible to adjust the control parameter manually. The feedback control may be considerably influenced by presetting the proportional range for heating or for cooling (P component) and the reset time for heating or for cooling (I component).

i Even small adjustments of the control parameters will lead to noticeable different control behaviour.

i The adaptation should start with the control parameter setting for the corresponding heating or cooling system according to the fixed values mentioned in the tables.

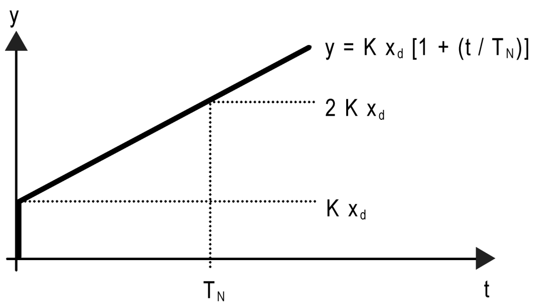

Figure 62: Function of the command value of a PI control

y: Command value
x_d: control difference ($x_d = x_{set} - x_{act}$)
P = 1/K : Configurable proportional band
K = 1/P : Gain factor
T_N: parameterisable reset time

PI control algorithm: Command value $y = K\ x_d\ [1 + (t / T_N)]$

Deactivation of the reset time (setting = "0") ->
P control algorithm: Command value $y = K\ x_d$

Parameter setting	Effect
P: Small proportional range	Large overshoot in case of setpoint changes (possibly permanently), quick adjustment to the setpoint
P: Large proportional range	No (or small) overshooting but slow adjustment
T_N: Short reset time	Fast compensation of control deviations (ambient conditions), risk of permanent oscillations
T_N: Long reset time	Slow compensation of control deviations

Table 5: Effects of the settings for the control parameters

Adapting the 2-point feedback control

2-point feedback control represents a very simple temperature control. For this type of feedback control, two hysteresis temperature values are set. The upper and lower temperature hysteresis limits can be adjusted via parameters. It has to be considered that…

- a small hysteresis will lead to small temperature variations but to a higher bus load,
- a large hysteresis switches less frequently but will cause uncomfortable temperature variations.

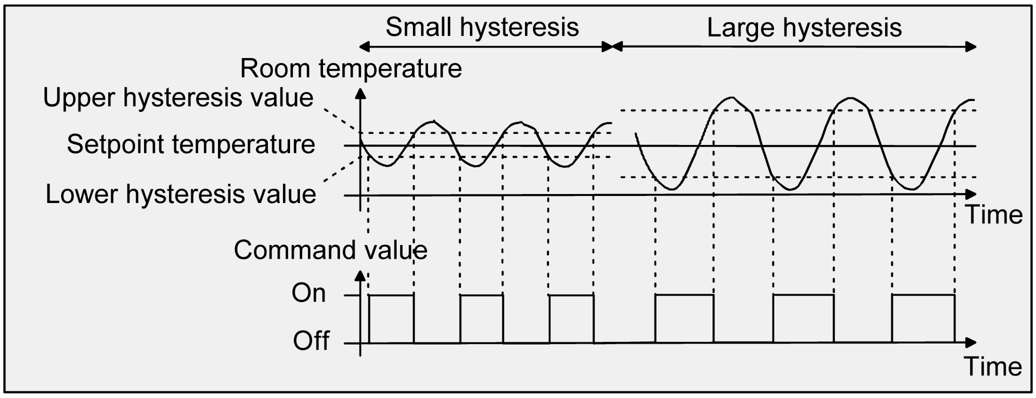

Figure 63: Effects of the hysteresis on the switching behaviour of the command value of 2-point feedback control

11.2.4 Operating mode and setpoints

Introduction - The operating modes

The room temperature controller has various operating modes. The selection of these modes will, for example, facilitate the activation of different temperature setpoints, depending on the presence of a person, on the state of the heating or cooling system, on the time of the day, or on the day of the week. The following operating modes can be distinguished…

- Comfort
  Comfort mode is usually activated if persons are in a room, and the room temperature should, for this reason, be adjusted to an adequately convenient value. The change-over to this operating mode can take place either by pressing a button or with presence control, for example, using a PIR motion detector on the wall or a ceiling mounted presence detector.
  An activated comfort mode can be indicated by the function of a status LED.
- Standby
  If a room is not used during the day because persons are absent, you can activate the Standby mode. Thereby, you can adjust the room temperature on a standby value, thus to save heating or cooling energy, respectively.
  The activated standby mode can be indicated by the function of a status LED.
- Night
  ☾
  During the night hours or during the absence of persons for a longer time, it mostly makes sense to adjust the room temperature to lower values for heating systems (e.g. in bedrooms). In this case, cooling system can be set to higher temperature values, if air conditioning is not required (e.g. in offices). For this purpose, you can activate the Night mode.
  The activated night mode can be indicated by the function of a status LED.
- Frost/heat protection
  ❄
  Frost protection will be required if, for example, the room temperature must not fall below critical values while the window is open. Heat protection can be required where the temperature rises too much in an environment which is always warm, mainly due to external influences. In such cases, you can activate the Frost/heat protection operating mode and prescribe some temperature setpoint of its own for either option, depending on whether "Heating" or "Cooling" has been selected, to prevent freezing or overheating of the room.
  The activated frost/heat protection can be indicated by the function of a status LED.
- Comfort extension (temporary Comfort mode)
  ☾ or ❄
  You can activate the comfort extension from the night or frost/heat protection mode (not triggered by the "Window status" object) and use it to adjust the room temperature to a comfort value for some time if, for example, the room is also 'used' during the night hours. This mode can exclusively be activated by a

presence button or also by the presence object, respectively. The comfort extension option will be automatically deactivated after a definable time has elapsed, or by pressing the presence button once more, or by receiving a presence object value = 0, respectively. You cannot retrigger this extension. The activated comfort prolongation option can be indicated by the function of a status LED.

i You can assign an own temperature setpoint to the "Heating" or "Cooling" operating modes for each operating mode.

11.2.4.1 Operating mode switchover

The operating mode is switched by the "Operating mode - Preset" object.

During the running time, the operating mode can be changed over through this value object immediately after the receipt of only one telegram. In this connection, the value received will set the operating mode. In addition, a second 1-byte object is available which, by forced control and through a higher level, can set an operating mode, irrespective of any other switchover options.

Taking the priority into account, a specific switchover hierarchy will result from the operating mode switchover by the objects, a distinction being made between presence detection by the presence button or the presence detector. In addition, the status of the windows in the room can be evaluated using the "Frost/heat protection - Window contact - Status" object, meaning that, when a window is open, the controller can switch to frost/heat protection mode, irrespective of the set operating mode, in order to save energy .

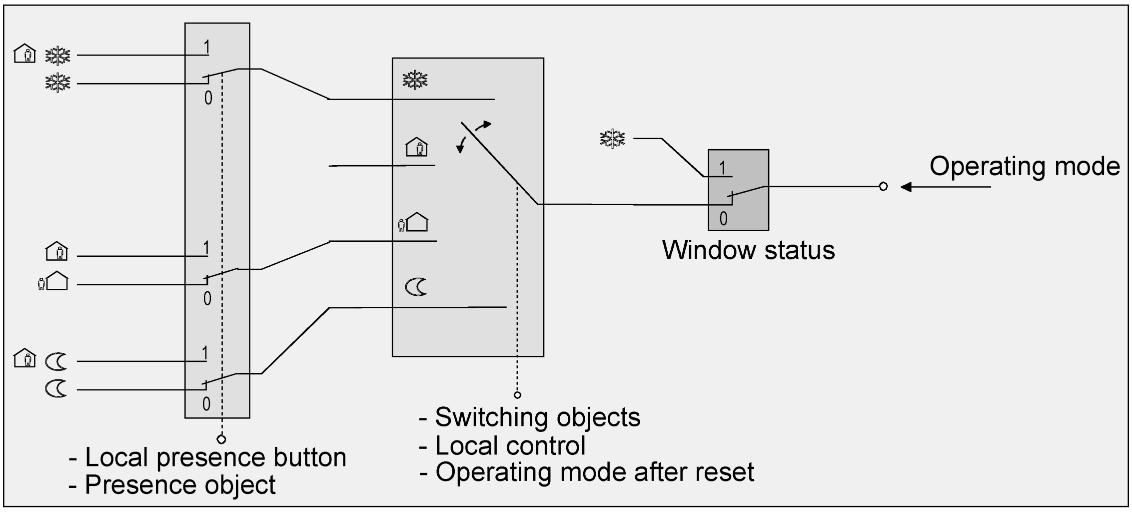

Figure 64: Operating mode switchover through KNX object with presence button

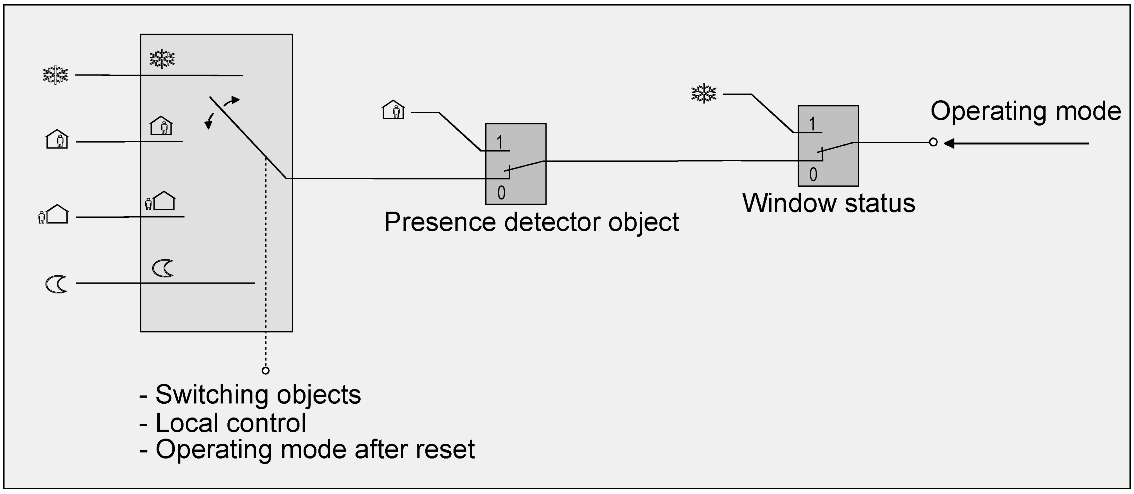

Figure 65: Operating mode switchover through KNX object with presence detector

Object value Operating mode	Object value Forced object oper.m.	object Window status	Presence button	Presence detector	Resulting operating mode
00	00	0	X	0	No modification
01	00	0	0	-	Comfort
02	00	0	0	-	Standby
03	00	0	0	-	Night
04	00	0	0	-	Frost/heat protection
01	00	0	1	-	Comfort
02	00	0	1	-	Comfort
03	00	0	1	-	Comfort extension
04	00	0	1	-	Comfort extension
01	00	0	-	0	Comfort
02	00	0	-	0	Standby
03	00	0	-	0	Night
04	00	0	-	0	Frost/heat protection
X	00	0	-	1	Comfort
X	00	1	-	X	Frost/heat protection
X	00	1	X	-	Frost/heat protection
X	01	X	X	X	Comfort
X	02	X	X	X	Standby
X	03	X	X	X	Night
X	04	X	X	X	Frost/heat protection

Status of the communication objects and the resulting operating mode

X: Status irrelevant
-: Not possible

i After mains voltage return or after an ETS programming operation, the value corresponding to the set operating mode is actively transmitted to the bus if the "Transmit" flag is set.

i In parameterisation of a presence button: the presence object will be active ("1") for the period of an active comfort extension. The presence object will be automatically deleted ("0") if the comfort extension is stopped after the extension time has elapsed, or if the operating mode has been changed by an operation through the switchover objects or a forced operating mode is deactivated by the KNX forced object (forced object -> "00"). The controller therefore automatically resets the status of the presence button when an object value is received via the operating mode objects or the forced object is reset.

11.2.4.2 Additional information on the presence function / comfort extension

Additional information on the presence function / comfort extension

With presence detection, the room temperature controller can quickly switch over to a comfort extension upon push-button actuation using a presence button or, using a presence detector, switch to Comfort mode when movement by a person in the room is detected.

The parameter "Presence detection" in the parameter node "Room temperature controller .. -> RTC .. - General -> Enabled functions" enables the parameter page "Presence detection". The remaining parameters can be set there.

In this regard, the parameter "Presence detection" determines whether presence detection is movement-controlled by a presence detector or done manually using a presence button:

– Presence detection by the presence button
  The 1-bit communication object "Presence detection - Presence button" is enabled. An "ON" telegram to this object makes it possible to switch to the comfort extension if night or frost/heat protection mode (not activated by the "Window contact" object) is active. The extension is automatically deactivated as soon as the configured "Length of comfort extension (0 = inactive)" time has elapsed. A comfort extension can be deactivated in advance if an "OFF" telegram is received via the object of the presence button. You cannot re-trigger such extension time.
  If you have set the length of comfort extension to "0" in the ETS (0 = inactive), you cannot activate a comfort extension from night or frost/heat protection mode. In this case, the operating mode will not be changed, although the presence function has been activated.
  If the standby mode is active, actuation on a presence object value = "ON" allows a switchover to the Comfort mode. This will also be the case if you have configured the length of comfort extension to "0". Comfort mode will remain active as long as the presence function remains active, or until another operating mode is specified.
  The presence function will always be deleted whenever a switchover to a different operating mode takes place, or after a forced operating mode has been deactivated (associated with KNX forced switchover). In the event of a device reset (power failure, ETS programming operation), an active presence function is always deleted.

i If, during an active comfort extension and with a frost/heat protection detection configured "via window contact" a window is opened, then the controller activates frost/heat protection immediately. The comfort extension remains active in the background and the configured time continues to elapse. If the time elapses and the window remains open, the presence is reset and an appropriate telegram is sent to the bus. However, if the window is closed again before the time has elapsed, then the comfort extension is executed again with the remaining run time.

– Presence detection by the presence detector
Two 1-bit communication objects "Presence detection - presence object" are enabled. With this objects it is possible to integrate presence detectors into room temperature control. If a movement is detected ("ON" telegram), the controller will switch to Comfort mode. In this connection, it is irrelevant what has been set by the switchover objects. Only a window contact or the KNX forced object are of higher priority.
Both objects form an "Or" link of two presence detectors. In larger rooms, the use of two presence detectors can be useful. As long as one of the two detectors detects a presence, the controller remains in comfort mode.
After the delay time has elapsed in the presence detector after a detected movement ("OFF" telegram), the controller will return to the mode which was active before presence detection, or it will compensate the telegrams of the operating mode objects received during presence detection, respectively.
In the event of a device reset (power failure, ETS programming operation), an active presence function is always deleted. In this case, the presence detector must transmit a new "1"-telegram to the controller to activate the presence function.

11.2.4.3 Additional information on the window status and the automatic frost protection

Additional information on the window status and the automatic frost protection

The room temperature controller offers various options to change over into the Frost/heat protection mode. In addition to switching over by means of the corresponding operating mode switchover object, frost/heat protection can be activated by a window contact, or alternatively, the frost protection can be activated by an automatic temperature function. The window contact or the automatic function has higher priority. The "Frost/heat protection" parameter determines how the switchover to forced frost/heat protection takes place:

– Frost/heat protection detection "via window contact (frost and heat protection)"

The 1-bit object "Window contact" is enabled. A telegram having the value of = "ON" (open window) and sent to this object will activate the frost/heat protection mode. If this is the case, the operating mode cannot be deactivated by the switchover objects (except for the KNX forced object) or the presence function. Only a telegram with the value = "OFF" (closed window) will reset the window status and deactivate the frost/heat protection mode. After this, the operating mode set before the opening of the window or that mode carried by the bus while the window was open will be activated.

You can optionally configure a delay for the evaluation of the window status. Such delay can make sense if short ventilation of the room by opening the window is not supposed to change the operating mode. The delay time is set by the "Delay time" parameter and can be between 1 and 255 minutes. The window status will only be changed and thus the frost/heat protection mode activated after this parameterized time has elapsed. A setting of "0" will effect the immediate activation of the frost/heat protection mode when the window is open. The window status will be in effect in the heating and in the cooling mode. After a power failure or ETS programming operation, the window status is always inactive.

– Frost protection detection "via temperature drop (frost protection only)"

  For this setting, automatic switchover to the frost protection mode can be made at times, depending on the room temperature determined.

  If there are no window contacts, this setting can prevent unnecessary heating up of a room when windows or external doors are open.

  With this function, a quick temperature drop can be detected by measuring the actual temperature every 4 minutes as is the case when a window is open in the winter months, for example. You can use the "Temperature drop detection from" parameter to set the maximum temperature drop in K / 4 min for switching over to the frost protection mode. If the controller detects that the room temperature has changed by at least the configured temperature jump within four minutes, frost protection is activated. After the time specified by the "Frost protection period" parameter has elapsed, the controller again automatically switches to the operating mode which was set before frost protection or which was tracked during automatic operation. It is not possible to retrigger an elapsing frost protection period.

i An activated automatic frost protection is cancelled by a setpoint shift, a setpoint change or an increase in the room temperature by 1 Kelvin.

i The KNX override object has a higher priority than the automatic frost protection mode and can interrupt the latter.

i The automatic frost protection mode only acts on heating for temperatures below the set value temperature of the operating mode selected. Thus, no automatic switchover to frost protection can take place at room temperatures in the deadband or in the active cooling mode if the "Heating and cooling" operating mode is on. Automatic heat protection activation is not intended with this parameterization.

i Frequent draughts in a room can cause unintentional activation/deactivation of frost protection when the automatic frost protection mode is active and if the set temperature decrease is too low. Therefore switching into the frost/heat protection mode by window contacts should generally be preferred to the automatic option.

Additional information on the operating mode after a reset

In the ETS, it is possible to use the parameter "Room temperature controller .. -> RTC .. - General" to set which operating mode should be activated after bus voltage return or re-programming by the ETS. The following settings are possible here.

– "Comfort operation" -> The comfort mode will be activated after the initialisation phase.
– "Standby mode" -> The standby mode will be activated after the initialisation phase.

- "Night operation" -> The night mode will be activated after the initializing phase.
- "Frost/heat protection operation" -> The frost/heat protection mode will be activated after the initialisation phase.
- "Restore operation mode before reset" -> The mode set before a reset according to the operating mode object or by button function (normal priority) will be restored after the initialisation phase of the device. Operating modes set by a function with a higher priority before the reset (Forced, Window status, Presence status) are not effected.

The objects associated with the activated operating mode will be updated after a reset.

11.2.4.4 Setpoint temperature presetting

Temperature setpoints can be preset for each operating mode in the ETS as part of first configuration. It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint presetting) or relatively (derivation from basic setpoint). The setpoint temperatures can later be adapted during regular operation if desired, controlled by the KNX communication objects.

The "Frost/heat protection" operating mode allows the separate configuration of two temperature setpoints for heating (frost protection) and cooling (heat protection) solely in the ETS. These temperature values cannot be changed later during controller operation.

The parameter "Setpoint specification" on the parameter page "Room temperature controller .. -> RTC .. - General -> Setpoints" defines the way in which the setpoint temperature is preset.

- Setting "relative"
  When presetting the setpoint temperatures for comfort, standby and night mode, attention has to be paid to the fact that all setpoints depend on each other as all values are derived from the basic temperature (basic setpoint temperature). The parameter "Basic setpoint temperature" on the parameter page "Room temperature controller .. -> RTC .. - General -> Setpoints" presets the basic setpoint that is loaded as the default value when the device is programmed by the ETS. Taking into account the "Standby" and "Night" parameters under the header "Temperature shift via operating mode", the temperature setpoints for the standby and night mode are derived from this value depending on the heating or cooling operating mode. The deadband will be additionally considered for the "Heating and cooling" operating mode.

  The 2-byte object "Setpoint temperature" - basic value" provides the option of changing the basic temperature, and thus all the dependent setpoint temperatures during device operation. A change via the object must always be enabled in the ETS by configuring the parameter "Approve changes via bus" to "active". The "Setpoint temperature - basic value" object is hidden if the basic setpoint temperature is not permitted to be changed via the bus. The controller module rounds the temperature values received via the "Setpoint temperature - basic value" object to the configured step width.

– "Absolute (independent setpoint temperatures)" setting
The setpoint temperatures for Comfort, Standby and Night mode are independent of each other. Depending on the operating mode and heating/cooling mode, various temperature values can be specified in the ETS within the range +7.0 °C to +40.0 °C. The temperature values are not checked in the ETS. It is thus possible, for example, to select smaller setpoint temperatures for cooling mode than for heating mode, or to specify lower temperatures for Comfort mode than for Standby mode.
After commissioning using the ETS the setpoint temperatures can be changed via the bus by means of temperature telegrams. This can be done using the communication object "Setpoint temperature - Active operating mode". When the controller receives a telegram via this object, it immediately sets the received temperature as the new setpoint of the active operating mode, and operates from then on with this setpoint. In this manner it is possible to adapt the setpoint temperatures of all operating modes separately for eating and cooling mode. The frost or heat protection temperature programmed using the ETS cannot be changed in this manner.

i With absolute setpoint setting there is no basic setpoint temperature and, in the mixed operating mode "Heating and cooling" (if necessary also with additional level), also no deadband. Consequently, the room temperature controller cannot control the switchover of the operating mode automatically, which is why, in this configuration, the setting for the parameter "Switchover between heating and cooling" is fixed in the ETS to "Via object". Furthermore, setpoint shifting does not exist for absolute setpoint presetting.

i In two-level control mode, all set-temperatures of the additional level are derived from the setpoint temperatures of the basic level. The setpoint temperature of the additional level are determined by subtracting the "Difference between basic and additional levels", which is permanently configured in the ETS, from the setpoints of the basic level in heating mode or by adding the setpoints in cooling mode. If the temperature setpoints of the basic level are changed, the setpoint temperatures of the additional level will be automatically changed as well. Both levels will heat or cool with the same command value at the same time when the level distance is "0".

The temperature setpoints programmed in the room temperature controller by the ETS during commissioning can be changed via communication objects. In the ETS, the parameter "Overwrite setpoints in the device during an ETS programming operation" on the "Room temperature control -> RTC - General -> RTC - Setpoints" to define whether the setpoints present in the device, which may have been changed subsequently, are overwritten during an ETS programming operation and are thus replaced again by the values configured in the ETS. If this parameter is "Active", then the setpoint temperatures are deleted in the device during a programming operation and replaced by the values of the ETS. If this parameter is configured to "Inactive", then setpoints present in the device remain unchanged. The setpoint temperatures entered in the ETS then have no significance.

ℹ During initial commissioning of the device the parameter "Overwrite setpoints in device during ETS programming" must be set to "Active" in order to perform valid initialisation of the memory slots in the device. The setting "Active" is also necessary if essential controller properties (operating mode, setpoint specification, etc.) are changed in the ETS through new parameter configurations.

11.2.4.5 Setpoint temperatures for relative setpoint presetting

Depending on the operating mode, different cases should be distinguished when specifying the relative setpoint temperature, which then have an impact on the temperature derivation from the basic setpoint.

Setpoints for operating mode "Heating"

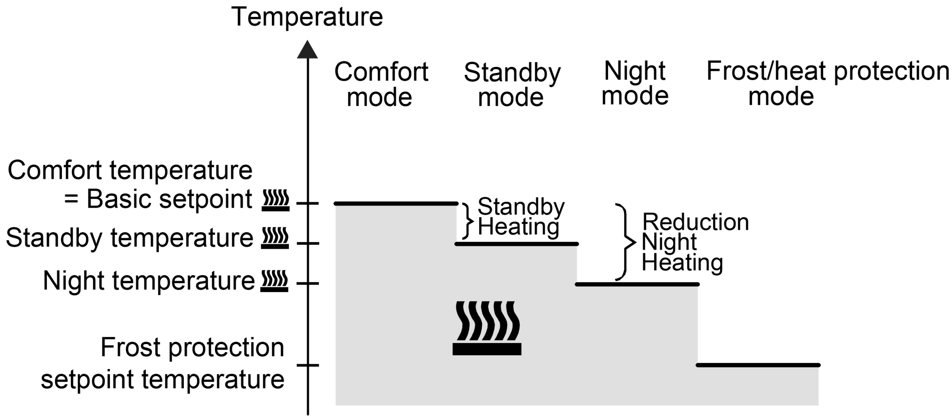

Figure 66: Setpoint temperatures in the operating mode "Heating"

The setpoint temperatures for Comfort, Standby and Night mode exist in this operating mode and the frost protection temperature can be preset (see figure 66). The following applies…

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

or

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

The standby and night setpoint temperatures are derived from the reduction temperatures configured in the ETS from the comfort setpoint temperature (basic setpoint temperature). The frost protection is supposed to prevent the heating system from freezing. For this reason, the frost protection temperature (default: +7 °C) should be set to a lower value than the night temperature. In principle, however, it is possible to select frost protection temperature values between +7.0 °C and +40.0 °C. The possible range of values for a setpoint temperature is bounded by the frost protection temperature in the lower range.

The level offset configured in ETS will be additionally considered in a two-level heating mode (see figure 67).

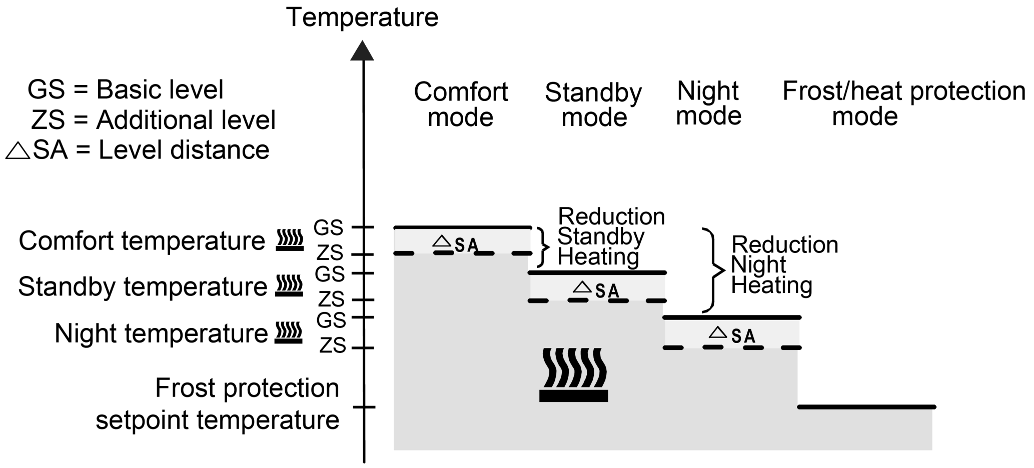

Figure 67: Setpoint temperatures in the operating mode "Basic and additional heating"

$T_{\text{Comfort setpoint additional level heating}} \leq T_{\text{Comfort setpoint basic level heating}}$

$T_{\text{Standby setpoint additional level heating}} \leq T_{\text{Standby setpoint basic level heating}}$

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

or

$T_{\text{Comfort setpoint additional level heating}} \leq T_{\text{Comfort setpoint basic level heating}}$

$T_{\text{Night setpoint additional level heating}} \leq T_{\text{Night setpoint basic level heating}}$

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

Setpoints for the "cooling" operating mode

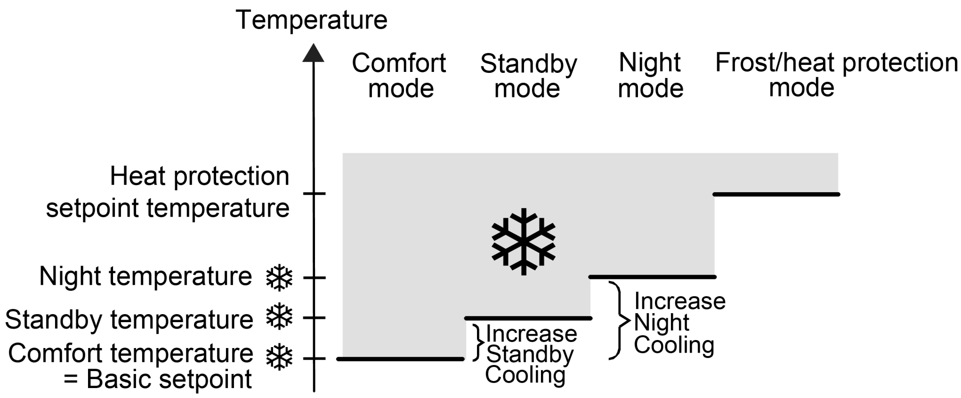

Figure 68: Setpoint temperatures in the operating mode "Cooling"

The setpoint temperatures for Comfort, Standby and Night mode exist in this operating mode and the heat protection temperature can be preset (see figure 68).
The following applies…

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

The standby and night setpoint temperatures are derived from the reduction temperatures configured in the ETS from the comfort setpoint temperature (basic setpoint temperature). The heat protection is intended to ensure that the temperature does not exceed the maximum permissible room temperature in order to protect system components. For this reason, the heat protection temperature (default: +35 °C) should be set to a higher value than the night temperature. In principle, however, it is possible to select heat protection temperature values between +7.0 °C and +45.0 °C. The possible range of values for a setpoint temperature is bounded by the heat protection temperature in the upper range.

The level offset configured in ETS will be additionally considered in a two-level cooling mode (see figure 69).

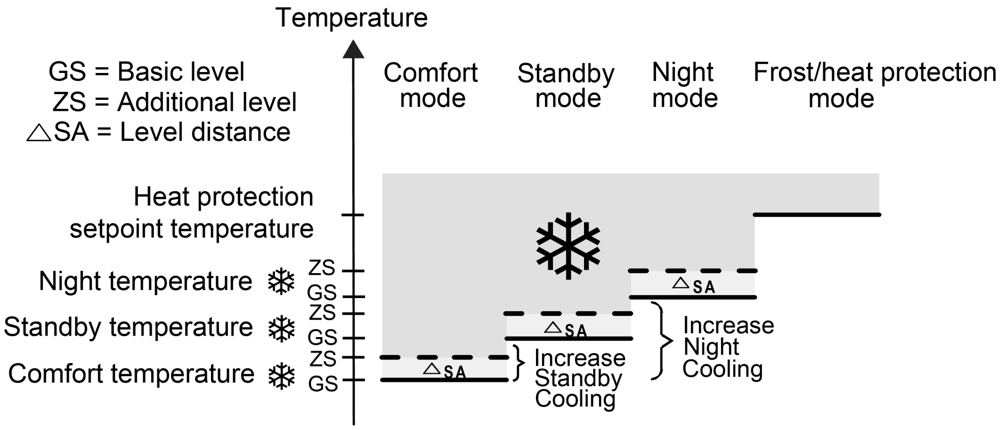

Figure 69: Setpoint temperatures in the operating mode "Basic and additional cooling"

$T_{\text{Comfort setpoint basic level cooling}} \leq T_{\text{Comfort setpoint additional level cooling}}$

$T_{\text{Standby setpoint basic level cooling}} \leq T_{\text{Standby setpoint additional level cooling}}$

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint basic level cooling}} \leq T_{\text{Comfort setpoint additional level cooling}}$

$T_{\text{Night setpoint basic level cooling}} \leq T_{\text{Night setpoint additional level cooling}}$

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

Setpoints for the "heating and cooling" operating mode

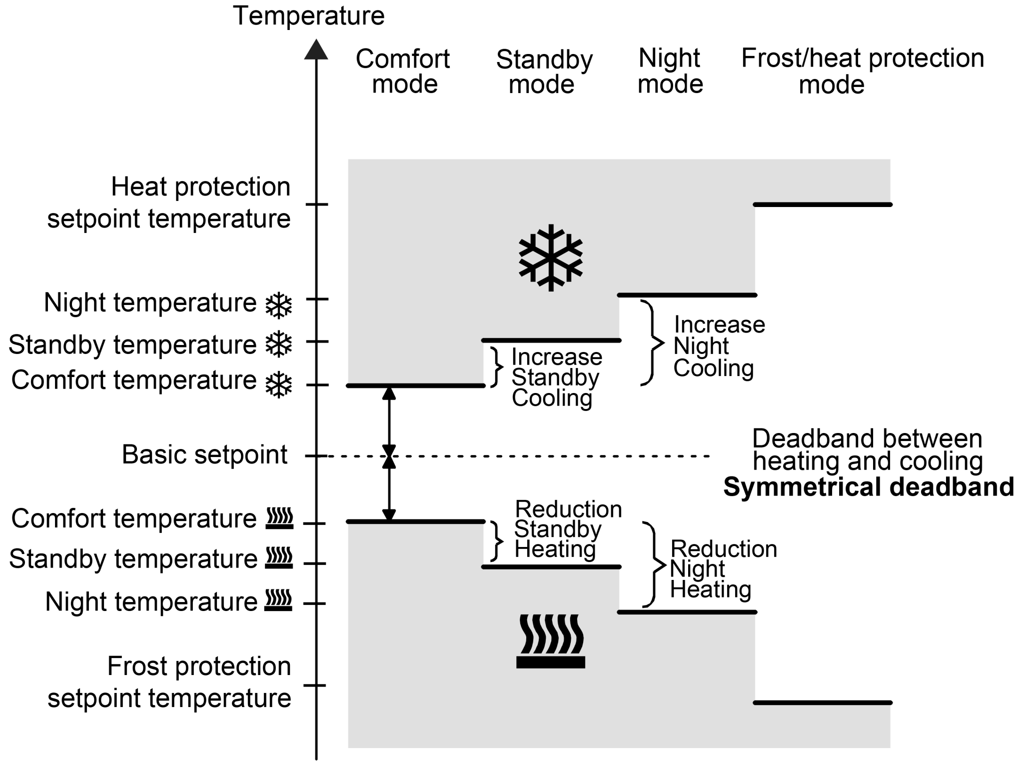

Figure 70: Setpoint temperatures in the operating mode "Heating and cooling" with symmetrical deadband

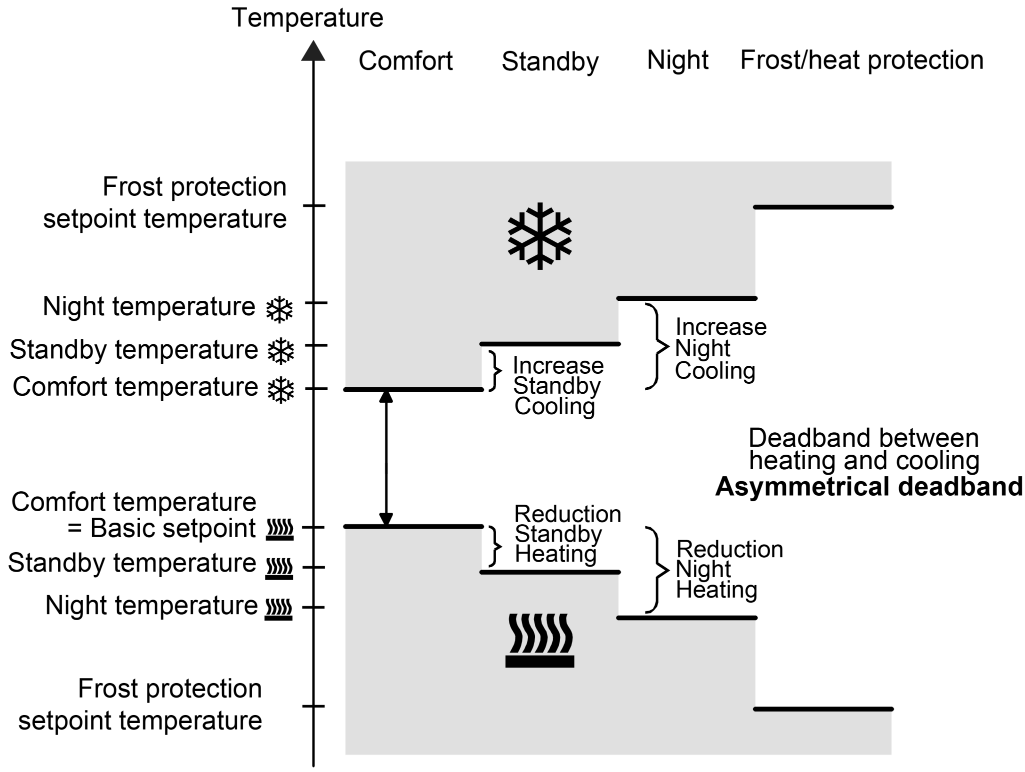

Figure 71: Setpoint temperatures in the operating mode "Heating and cooling" with asymmetrical deadband

For this heating/cooling operating mode, the setpoint temperatures of both heating/cooling modes exist for the Comfort, Standby and Night operating modes as well as the deadband. A distinction is made in the deadband position with combined heating and cooling. A symmetrical (see figure 70) or an asymmetrical (see figure 71) deadband position can be configured. In addition, the frost protection and the heat protection temperatures can be preset.

The following applies…

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

The standby and night setpoint temperatures are derived from the comfort setpoint temperatures for heating or cooling. The temperature increase (for cooling) and the temperature decrease (for heating) of both operating modes can be preset in ETS. The comfort temperatures themselves are derived from the deadband and the basic setpoint temperature. The frost protection is supposed to prevent the heating system from freezing. For this reason, the frost protection temperature (default: +7 °C) should be set to a lower value than the night temperature for heating. In principle, however, it is possible to select frost protection temperature values between +7.0 °C and +40.0 °C. The heat protection is intended to prevent the temperature from exceeding the maximum permissible room temperature in order to protect system components. For this reason, the heat protection temperature (default: +35 °C) should be set to a higher value than the night temperature for cooling. In principle, however, it is possible to select heat protection temperature values between +7.0 °C and +45.0 °C. The possible range of values for a setpoint temperature ("heating and cooling") lies between +7.0 °C and +45.0 °C and is bounded by the frost protection temperature in the lower range and by the heat protection temperature in the upper range.

The level offset configured in ETS will be additionally considered in a two-level heating or cooling mode.

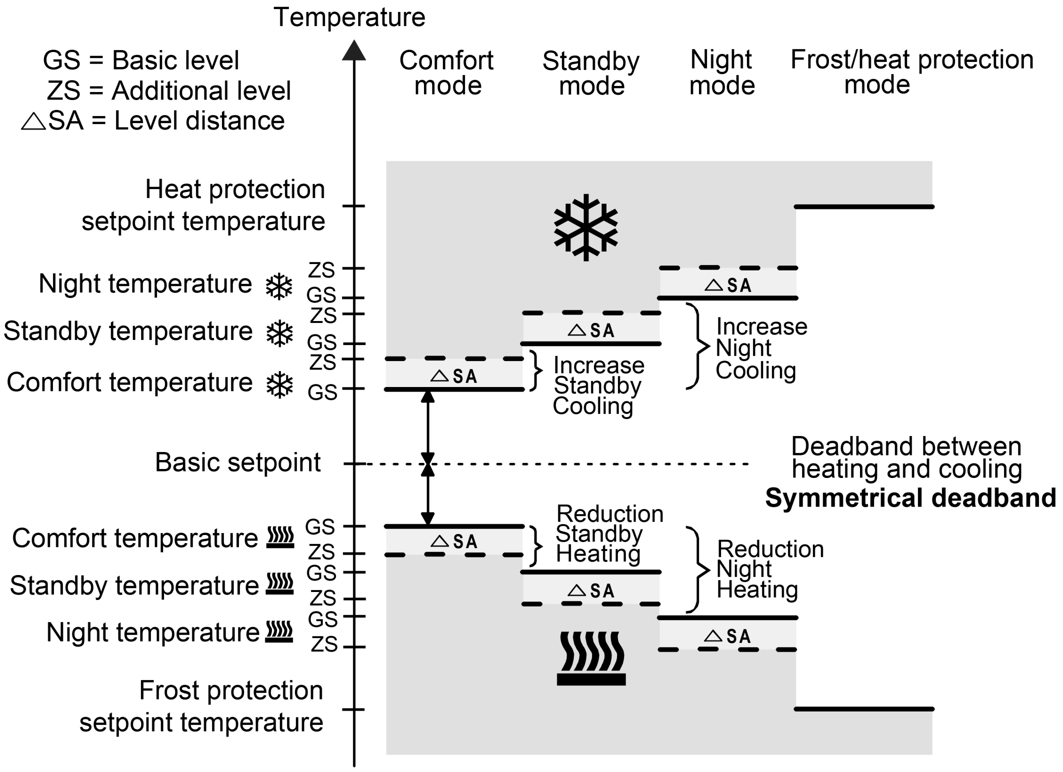

Figure 72: Setpoint temperatures in the operating mode "Basic and additional heating and cooling" with symmetrical deadband

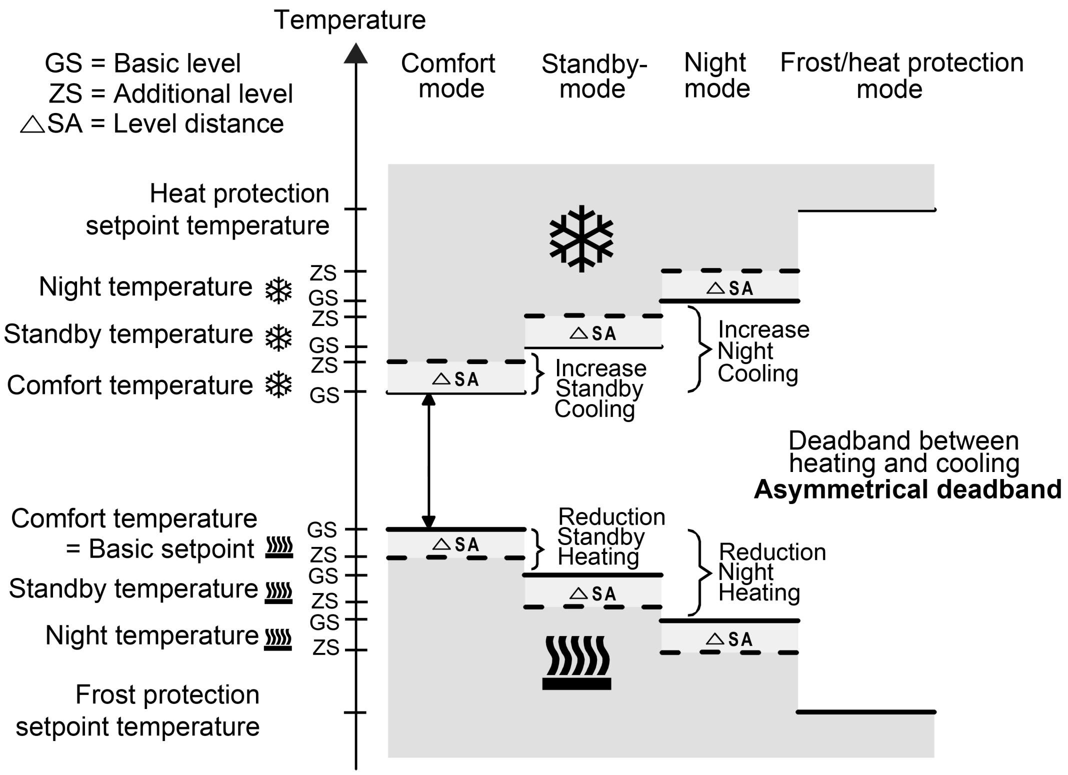

Figure 73: Setpoint temperatures in the operating mode "Basic and additional heating and cooling" with asymmetrical deadband

$T_{\text{Comfort setpoint add. level Heating}} \leq T_{\text{Comfort setpoint basic level Heating}} \leq T_{\text{Comfort setpoint basic level Cooling}} \leq T_{\text{Comfort setpoint add. level Cooling}}$

$T_{\text{Standby setpoint add. level Heating}} \leq T_{\text{Standby setpoint basic level Heating}} \leq T_{\text{Standby setpoint basic level Cooling}} \leq T_{\text{Standby setpoint add. level Cooling}}$

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint add. level Heating}} \leq T_{\text{Comfort setpoint basic level Heating}} \leq T_{\text{Comfort setpoint basic level Cooling}} \leq T_{\text{Comfort setpoint add. level Cooling}}$

$T_{\text{Night setpoint add. level Heating}} \leq T_{\text{Night setpoint basic level Heating}} \leq T_{\text{Night setpoint basic level Cooling}} \leq T_{\text{Night setpoint add. level Cooling}}$

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

In the case of switching 2-point feedback control, the hysteresis values must additionally be taken into account.

Deadband and deadband positions in the combined heating and cooling operating mode

With relative setpoint presetting, the comfort setpoint temperatures for heating and cooling are derived from the basic setpoint temperature in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures. This deadband does not exist for absolute setpoint presetting.

The parameters "Deadband between heating and cooling", "Allocation of deadband" and "Basic setpoint temperature" are specified in the ETS configuration. One distinguishes between the following settings...

- Allocation of deadband = "symmetrical"

  The deadband preset in the ETS is split up into two parts at the basic setpoint temperature. Based on the resulting half deadband, the comfort setpoint temperatures are derived directly from the basic setpoint temperature.
  The following applies...

  $T_{\text{Basic setpoint}} - \frac{1}{2}T_{\text{Deadband}} = T_{\text{Comfort setpoint heating}}$

  and

  $T_{\text{Basic setpoint}} + \frac{1}{2}T_{\text{Deadband}} = T_{\text{Comfort setpoint cooling}}$
  -> $T_{\text{Comfort setpoint cooling}} - T_{\text{Comfort setpoint heating}} = T_{\text{Deadband}}$
  -> $T_{\text{Comfort setpoint cooling}} \geq T_{\text{Comfort setpoint heating}}$

- Allocation of deadband = "asymmetrical"

  With this setting the comfort setpoint temperature for heating equals the basic setpoint temperature. The deadband specified in the ETS is effective only from the basic setpoint temperature in the direction of the comfort temperature for cooling. Thus the comfort setpoint temperature for cooling is derived directly from the comfort setpoint for heating.

  The following applies...

  $T_{\text{Basic setpoint}} = T_{\text{Comfort setpoint heating}}$
  -> $T_{\text{Basic setpoint}} + T_{\text{Deadband}} = T_{\text{Comfort setpoint cooling}}$

-> $T_{\text{Comfort setpoint cooling}} - T_{\text{Comfort setpoint heating}} = T_{\text{Deadband}}$

-> $T_{\text{Comfort setpoint cooling}} \geq T_{\text{Comfort setpoint heating}}$

11.2.4.6 Accept setpoints permanently

If the basic setpoint has been modified by the communication objects "Setpoint temperature - Basic value" or "Setpoint temperature - Active operating mode", two possible cases can be distinguished, which are set by the parameter for modification via bus "Permanently apply" (with relative setpoint presetting) or "Accept modification via bus permanently" (with absolute setpoint presetting)...

- Case 1: The setpoint adjustment is permanently accepted ("Active" setting):
  If, with this setting, the setpoint temperature is adjusted, the controller saves the value permanently to the device memory. The newly adjusted value will overwrite the initial value, i.e. the basic temperature originally configured via the ETS after a reset or the absolute setpoint temperature loaded using the ETS. The changed values are also retained after a device reset, after a switchover of the operating mode or after a switchover of the heating/cooling mode (with absolute setpoint specification individually for each operating mode for heating and cooling).
  The "Basic setpoint temperature" object (relative setpoint presetting) is not bidirectional, meaning that a shifted basic setpoint is not signalled back to the KNX. The "Setpoint temperature active operating mode" object (absolute setpoint temperature specification) can be bidirectional if required ("Transmit" flag set!). This makes it possible to use this object to feedback to the bus the setpoint temperature resulting from a setpoint shift.
- Case 2: The basic setpoint adjustment is only temporarily accepted ("Inactive" setting):
  The setpoints received via the objects remain active only temporarily. In case of a bus voltage failure, after a switchover to another operating mode (e.g. Comfort to Standby, or also Comfort to Comfort), or after a switchover of the operating mode (e.g. Heating to Cooling), the last setpoint changed will be discarded and replaced by the initial value.

If the setpoint is accepted on a non-temporary basis ("Active" setting), the setpoint temperatures restored after a device reset are not effected immediately in the communication objects. Only after the telegrams have been received from the bus via the objects and the room temperature controller accepts the newly received setpoint temperatures can the objects be read out, for example for visualisation purposes (Set "Read" flag!).

With relative setpoint presetting: Independent of the "Accept permanently" parameter, the temperature setpoints for the standby, night or for "cooling" comfort mode (deadband) will always be stored in the device.
With absolute setpoint presetting: As described, dependent on the "Accept modification permanently via bus" parameter, the temperature setpoints for the standby or night mode for heating or cooling will always be stored in the volatile or non-volatile memory.

11.2.4.7 Basic setpoint temperature shift for relative setpoint temperature specification

In addition to presetting individual temperature setpoints by the ETS or basic setpoint object, the user, when presetting relative setpoint temperatures, can shift the basic setpoint in predefined limits within a specific range. When doing so, the basic setpoint is adjusted up or down in levels. The value of a level is 0.5 K.

No basic setpoint shift can be performed if the controller is configured for absolute setpoint presetting.

It has to be considered that a shift of the displayed setpoint temperature (temperature offset of the basic temperature) will directly affect the basic setpoint and as a result shift all other temperature setpoints!
A positive shift is possible up to the configured heat protection temperature. A negative shift is possible up to the set frost protection temperature.

The object "Setpoint temperature - Basic value" is not bidirectional, meaning that a shifted basic setpoint is not signalled back to the KNX.

Whether a setpoint temperature shift only affects the currently active operating mode or whether it influences all other setpoint temperatures of the remaining operating modes is determined by the "Accept modification of shift permanently" parameter in the "Room temperature controller" parameter page... -> RTC .. General -> Setpoints".

– "Inactive" setting:
  The basic setpoint temperature shifting carried out is in effect for only as long as the operating mode or heating/cooling mode has not changed or the basic setpoint is maintained. Otherwise the setpoint shift will be reset to "0".
– "Active" setting:
  The shift of the basic setpoint temperature carried out generally affects all operating modes. The shift is maintained even after a switchover of the operating mode or the heating/cooling mode or adjusting the basic setpoint temperature.

Since the value for the setpoint temperature shift is stored exclusively in volatile memory (RAM), the shift will get lost in case of a reset (e.g. bus voltage failure).

A setpoint shift does not affect the temperature setpoints for frost or heat protection.

Communication objects for the basic setpoint shift:

The setpoint temperature shift of the controller can be set externally using the "Setpoint temperature - shift" communication object with a 1-byte counter value (in accordance with KNX DPT 6.010 – display of positive and negative values in two's complement). By connecting to the object "Setpoint temperature – shift" the controller extensions are able to directly adjust the current setpoint shifting of the controller. As soon as the controller receives a value, it will adjust the setpoint shift correspondingly. Values that lie within the possible value range of the setpoint temperature shift can be directly jumped to.
The controller monitors the received value independently. As soon as the external preset value exceeds the limits of the adjustment options for the setpoint shift in positive or negative direction, the controller will correct the received value and adjust the

setpoint shift to maximum. Depending on the direction of the shift, the value feedback is set to the maximum value via the communication object "Current setpoint shift".

The current setpoint shift is tracked by the controller in the "Setpoint temperature - Shift - Status" communication object. This object has the same data point type and value range as the "Setpoint temperature - shift" object (see above). By connecting to this object, the room temperature control points are also able to display the current setpoint shift. As soon as there is an adjustment by one temperature increment in positive direction, the controller counts up the value. The counter value will be counted down if there is a negative adjustment of the temperature. A value of "0" means that no setpoint shifting has been adjusted.

Example:
Starting situation: current setpoint temperature = 21.0°C / Counter value in "Current setpoint shift" = "0" (no active setpoint shift)
After the setpoint shifting:
-> A setpoint shift by one temperature increment in the positive direction will count up the value in the "Current setpoint shift" object by one = "1"
-> Current setpoint temperature = 21.5°C
-> An additional setpoint shift by one temperature increment in the positive direction will again count up the value in the "Current setpoint shift" object by one = "2"
-> Current setpoint temperature = 22.0°C
-> A setpoint shift by one temperature increment in the negative direction will count down the value in the "Current setpoint shift" object by one = "1"
-> Current setpoint temperature = 21.5°C
-> An additional setpoint shift by one temperature increment in the negative direction will again count down the value in the "Current setpoint shift" object by one = "0"
-> Current setpoint temperature = 21.0°C
-> An additional setpoint shift by one temperature increment in the negative direction will again count down the value in the "Current setpoint shift" object by one = "-1"
-> Current setpoint temperature = 20.5°C, etc. ...

To ensure that controller extensions indicate the correct shifts and also control the functions of the controller (as main unit) correctly, it is necessary for the room temperature control points to be set to the same shift limits of the setpoint shift as the main unit. Room temperature control points must work with the same step width for the setpoint shift as the controller itself (0.5 K).

11.2.4.8 Display function for basic setpoint temperature shift with relative setpoint temperature specification

Optionally, the setpoint of the respective current operating mode can be shown automatically in the display if a setpoint temperature shift is performed using the buttons of the device ("Setpoint temperature shift" button function). The setpoint temperature is then displayed temporarily for 5 s in °C or °F, and overwrites the normal display (actual temperature, etc.).
The setpoint display in the case of a setpoint temperature shift can be activated by setting the "Show temporary setpoint controller n on setpoint shift?" parameter to

"Yes". With the setting "No" the temporary display is inactive, meaning that in case of a setpoint shift only the line graphic "- - - - 0 - - - -" is activated, but the temperature value is not also displayed automatically.

Depending on the configuration in the ETS, the normal depiction of the display can show various display information with cyclical change or by button control, including the setpoint temperature. Therefore for a setpoint shift a distinction is made among the following cases...

– The temporary setpoint display for setpoint shift is **active**. At the time the button is pressed for a setpoint shift the setpoint temperature is **not** visible in the display via the cyclical change of the display information or via a previous "change in the display reading" button call-up. One button-press will shift the temperature by one level. The setpoint remains visible in the display for 5 s. After that the display switches back to the normal display, if the button for the setpoint shift is not pressed another time. Additional button actuations shift the setpoint temperature value again and cause it to be visible in the display for another 5 seconds.
– The temporary setpoint display for setpoint shift is **active**. At the time the button is pressed for a setpoint shift the setpoint temperature is visible in the display via the cyclical change of the display information or via a previous "change in the display reading" button call-up.
  The indication of the setpoint is updated in the display and thus shows the shifted setpoint temperature. However, the setpoint only remains visible in the display for the configured time of the cyclical change. After that the display switches over to the next piece of display information, if the button for the setpoint shift is not pressed another time. Additional button actuations activate the temporary setpoint display and cause the setpoint temperature value to be visible in the display for at least another 5 seconds.
– The temporary setpoint display for setpoint shift is **inactive**. At the time the button is pressed for a setpoint shift the setpoint temperature is visible in the display via the cyclical change of the display information or via a previous "change in the display reading" button call-up.
  The indication of the setpoint is updated in the display and thus shows the shifted setpoint temperature. However, the setpoint only remains visible in the display for the configured time of the cyclical change. After that the display switches over to the next piece of display information. The setpoint shift is then only shown via the line graphic, and no longer as a temperature value, even in case of further button-presses.

No temporary setpoint display takes place if a setpoint shift is performed in the menu level of the device or via the communication objects (e.g. via controller extensions).

11.2.4.9 Setpoint shift with absolute setpoint presetting

In addition to the setting of individual temperature setpoints via the ETS or via the setpoint temperature object, with absolute setpoint presetting the user is also able to shift the setpoint via the basic setpoint object with the "Room temperature control point - Setpoint temperature shift" button function, if this is configured to a function button of the device. Each time a button is pressed, the setpoint is shifted upwards or downwards (depending on the button operation and parameterisation) by one level (0.1 K or 0.5 K). The step value corresponds to the designed "Setpoint shift value". Hold the button down for continuous shifting.

With absolute setpoint presetting the setpoint shift directly affects the object "Setpoint active operating mode" and thus directly only the specified setpoint temperature of the specific active operating mode. The last setpoint temperature specified via the bus or by the ETS is first overwritten by a shift. If the "Accept modification of the set-point value permanently" parameter is set to "Yes", the controller saves the shifted temperature value in non-volatile device memory. Otherwise (setting "No") the shifted setpoint remains active only temporarily for the active operating mode. It sets itself back to the initial value if the operating mode or the heating/cooling mode is switched over or a device reset is performed.
The setpoint temperatures of other operating modes for heating or cooling are not affected by the shifting of the setpoint of a specific operating mode. If, for example, the setpoint temperature for the comfort mode for heating is shifted, the other setpoints for night or standby mode for heating and cooling remain unchanged. If a shift is desired here, too, then the temperature values must be shifted individually.

In the case of relative setpoint presetting, shifting of the basic setpoint is possible. If accepted on a non-temporary basis this has an effect on all operating modes of the controller, and thus differs from the setpoint shift for absolute setpoint presetting.

The object "Setpoint active operating mode" can be bidirectional if necessary (set "Transmit" flag!). This makes it possible to use this object to feedback to the bus the setpoint temperature of an operating mode resulting from a setpoint shift.

A setpoint shift does not affect the temperature setpoints for frost or heat protection.

In the case of absolute setpoint presetting, a setpoint shift can only be performed on main controllers. A "setpoint shift" is only available on a control extension if the main controller is working with relative setpoint presetting (basic setpoint). In the case of an absolute setpoint shift on the main controller, the setpoint shift on the controller extension has no effect. In this case controller extensions can forward setpoints to main controllers, for example by pressing a function button (Temperature value transmitter to the "Setpoint active operating mode" object).

11.2.4.10 Transmitting the setpoint temperature

Transmitting the setpoint temperature

The setpoint temperature, which is specified for the active operating mode, can be actively transmitted onto the bus via the
2-byte "Setpoint temperature - Basic value - Status" object. The parameter "On change by (0 = inactive)" in the parameter node "Room temperature controller .. -> RTC .. General -> Setpoints" specifies the temperature value by which the setpoint value has to change in order to have the setpoint temperature value transmitted automatically via the object. Possible temperature value changes lie within a range of 0.1 K and 25.5 K. The setting "0" at this point will deactivate the automatic transmission of the setpoint temperature.

In addition, the setpoint can be transmitted periodically. The parameter "Cyclical" specifies the cycle time (1 to 255 minutes). The value "0" will deactivate the cyclical transmission of the setpoint temperature value. It has to be pointed out that with deactivated periodical transmission and deactivated automatic transmission, no setpoint temperature telegrams will be transmitted in case of a change!
Setting the "Read" flag on the "Setpoint temperature" object makes it possible to read out the current setpoint. After the bus voltage return or after re-programming via the ETS, the object value will be initialised according to the current setpoint temperature value and actively transmitted to the bus.

11.2.4.11 Operating mode and setpoint parameters

Overwrite setpoints in device during ETS programming operation	**Active** Inactive
The setpoint temperatures programmed in the room temperature controller by the ETS during commissioning can be changed via communication objects. This parameter can be used to define whether the setpoints present in the device, which may have been changed subsequently, are overwritten during an ETS programming operation and thus replaced again by the values parameterised in the ETS. If this parameter is "Active", then the setpoint temperatures are deleted in the device during a programming operation and replaced by the values of the ETS. If this parameter is configured to "Inactive", then setpoints present in the device remain unchanged. The setpoint temperatures entered in the ETS then have no significance.	

Setpoint presetting	**Absolute** Relative
It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint presetting) or relatively (derivation from basic setpoint). This parameter defines the way the setpoint temperature is preset. With "Relative": All temperature setpoints are derived from the basic temperature (basic setpoint temperature). With "Absolute": The setpoint temperatures are independent of each other. Different temperature values can be specified for each operating mode and heating/cooling mode.	

Setpoint temperatures via operating mode for absolute setpoint presetting

Heating

Comfort	7 ... **21.0** ... 40 °C
With absolute setpoint presetting the setpoint temperatures for Comfort, Standby and Night mode are independent of each other. Depending on the operating mode and heating/cooling mode, various temperature values can be specified in the ETS within the range +7.0 °C to +40.0 °C. The ETS does not validate the temperature values. It is thus possible, for example, to select smaller setpoint temperatures for cooling mode than for heating mode, or to specify lower temperatures for Comfort mode than for Standby mode. After commissioning using the ETS the setpoint temperatures can be changed via the bus by means of temperature telegrams. This can be done using the communication object "Setpoint temperature - Active operating mode". Presetting of the setpoint temperature for the Comfort heating mode. These parameters are only visible with absolute setpoint presetting!	

Standby	7 ... **19.0** ... 40 °C
Presetting of the setpoint temperature for Standby mode (heating).	

Night	7 ... **17.0** ... 40 °C
Presetting of the setpoint temperature for night mode (heating).	

Frost protection	7.0 ... 40 °C
Presetting of the setpoint temperature for frost protection mode (heating).	

Cooling

Comfort	7 ... 23.0 ... 40 °C
Presetting of the setpoint temperature for the comfort cooling mode.	

Standby	7 ... 25.0 ... 40 °C
Presetting of the setpoint temperature for Standby mode (cooling).	

Night mode	7 ... 27.0 ... 40 °C
Presetting of the setpoint temperature for night mode (cooling).	

Heat protection	7 ... 35.0 ... 45 °C
Presetting of the setpoint temperature for cooling heat protection mode.	

Accept changes permanently via bus	Active Inactive
One has to distinguish between two cases, defined by this parameter, if the setpoint has been modified via the object. This parameter is only visible with absolute setpoint presetting! When "Active": If, with this setting, the setpoint temperature is adjusted, the controller saves the value permanently to the permanent storage. The newly adjusted value will overwrite the initial value, i.e. the absolute setpoint temperature originally loaded using the ETS. The changed values are also retained after a device reset, after a switchover of the operating mode or after a switchover of the heating/cooling mode (with absolute setpoint specification individually for each operating mode for heating and cooling). When "Inactive": The setpoints received via the object remain active only temporarily. In case of a bus voltage failure, after switching over to another operating mode (e.g. comfort to standby, or also comfort to comfort), or after switching over the operating mode (e.g. heating to cooling), the last setpoint changed will be discarded and replaced by the initial value.	

Difference between basic and additional level	0 ...2...12.7 K
In a two stage control mode it is necessary to determine the temperature difference to the basic stage with which the additional stage is to be incorporated into the control. This parameter defines the level spacing. The parameter can only be seen in two-level control operation.	

Setpoint temperatures via operating mode for relative setpoint presetting

Basic setpoint temperature	7 ... **22.0** ... 40 °C
This parameter defines the temperature value to be applies as the basic setpoint after commissioning by the ETS. All the temperature setpoints are derived from the basic setpoint. This parameter is only visible with relative setpoint presetting!	

Approve change via bus	**Active** Inactive
Here, it is possible to specify if it is possible to change the basic setpoint via the bus. This parameter is only visible with relative setpoint presetting!	

Accept permanently	**Active** Inactive
In addition to specifying individual setpoint temperatures by the ETS or basic setpoint object, the user can shift the basic setpoint in a specific range via a communication object. Whether a basic setpoint shifting only affects the currently active operating mode or whether it influences all other setpoint temperatures of the remaining operating modes is determined by this parameter. In the "Active" setting, the shift of the basic setpoint carried out affects all operating modes. The shift is maintained even after a switchover of the operating mode or the heating/cooling mode or adjusting the basic setpoint. The changed values are also retained after a device reset. In the "Inactive" setting, the basic setpoint shift carried out is in effect for only as long as the operating mode or heating/cooling mode has not changed or the basic setpoint is maintained. Otherwise the setpoint shift will be reset to "0". This parameter is only visible with relative setpoint presetting!	

Temperature shift via operating mode for relative setpoint presetting

Heating

Standby	-10...**-2**...0 K
The value by which the standby setpoint temperature for heating is lowered compared to the heating comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Night	-10...**-4**...0 K
The value by which the night temperature for heating is lowered compared to the heating comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Frost protection	**7.0** ... 40 °C
This parameter specifies the setpoint temperature for frost protection. The parameter is only visible in "Heating" or "Heating and cooling" operating modes (if necessary with additional levels).	

Cooling

Standby	0...**2**...10 K
The value by which the standby setpoint temperature for cooling is raised compared to the cooling comfort temperature. The parameter is only visible in the "Cooling" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Night	0...**4**...10 K
The value by which the night temperature for cooling is raised compared to the cooling comfort temperature. The parameter is only visible in the "Cooling" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Heat protection	7 ... **35.0** ... 45 °C
This parameter specifies the setpoint temperature for heat protection. The parameter is only visible in "Cooling" or "Heating and cooling" operating modes (if necessary with additional levels).	

Difference between basic and additional level	0...**2**...12.7 K
In a two stage control mode it is necessary to determine the temperature difference to the basic stage with which the additional stage is to be incorporated into the control. This parameter defines the level spacing. The parameter can only be seen in two-level control operation.	

Setpoint temperature shift for a relative setpoint specification

Type of shift	Via counter value x step width **Via relative temperature value**
Depending on the setting of the parameter "Type of shift", the shift takes place via a 2-byte communication object (acc. to KNX DPT 9.002) or via a 1-byte communication object (acc. to KNX DPT 6.010). This parameter is only visible with relative setpoint presetting!	

Accept changes permanently	**Active** Inactive
In addition to specifying individual setpoint temperatures by the ETS or basic setpoint object, the user can shift the basic setpoint in a specific range using the sensor buttons or a communication object. Whether a basic setpoint shifting only affects the currently active operating mode or whether it influences all other setpoint temperatures of the remaining operating modes is determined by this parameter. In the "Active" setting, the shift of the basic setpoint carried out affects all operating modes. The shift is maintained even after a switchover of the operating mode or the heating/cooling mode or adjusting the basic setpoint. In the "Inactive" setting, the basic setpoint shift carried out is in effect for only as long as the operating mode or heating/cooling mode has not changed or the basic setpoint is maintained. Otherwise the setpoint shift will be reset to "0".	

Value adjustment

Maximum shift upwards	0 K + 1 K + 2 K + 3 K + 4 K + 5 K + 6 K + 7 K **+ 8 K** + 9 K + 10 K
This is used to define the maximum range in which the basic setpoint temperature can be adjusted upwards. This parameter is only visible with relative setpoint presetting and shift via relative temperature value.	

Maximum shift downwards	0 K - 1 K - 2 K - 3 K - 4 K - 5 K - 6 K - 7 K **- 8 K** - 9 K - 10 K
This is used to define the maximum range in which the basic setpoint temperature can be adjusted downwards. This parameter is only visible with relative setpoint presetting and shift via relative temperature value.	

Increment, four-level	**0.5 K** 1.0 K 1.5 K 2.0 K

This parameter defines the value of a level of the setpoint shift. With a setpoint shift, the basic setpoint (with relative setpoint specification) is changed by the temperature value configured here when there is an adjustment by one step in a positive or negative direction. The controller module rounds the temperature values received via the "Setpoint temperature - Basic value" object and matches the values to the step width configured here.

The parameter is only available if the shift has the setting "Via counter value x step width".

In combination with the function "Setpoint heating temperature increase", the setpoint temperature can also be modified in smaller steps, even with a step width of 0.5 K.

Deadband between heating and cooling

Allocation of deadband	**Symmetrical** Asymmetrical

With relative setpoint presetting, the comfort setpoint temperatures for the operating mode "Heating and cooling" are derived from the basic setpoint in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures.
Symmetrical setting: The deadband preset in the ETS plug-in is divided in two parts at the basic setpoint. Based on the resulting half deadband, the comfort setpoint temperatures are derived directly from the basic setpoint (Basic setpoint - 1/2 deadband = Heating comfort temperature or Basic setpoint + 1/2 deadband = Cooling comfort temperature).

Asymmetrical setting: With this setting the comfort setpoint temperature for heating equals the basic setpoint! The preset deadband is effective only from the basic setpoint in the direction of comfort temperature for cooling. Thus the comfort setpoint temperature for cooling is derived directly from the comfort setpoint for heating.
The parameter is only visible in the "Heating and cooling" operating mode (if necessary with additional levels), an automatic heating/cooling changeover by the RTC, and only with relative setpoint presetting!

Size	0.1...**1**...25.5 K

With relative setpoint presetting, the comfort setpoint temperatures for heating and cooling are derived from the basic setpoint in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures. It is set using this parameter.
The parameter is only visible in the "Heating and cooling" operating mode (if necessary with additional levels), an automatic heating/cooling changeover by the RTC, and only with relative setpoint presetting!

Setpoint temperature transmission behaviour

On change by (0 = inactive)	0...**0.1**...25.5 K
Determines the size of the value change required to transmit the current value automatically to the bus via the "Setpoint temperature" object. In the "0" setting, the setpoint temperature is not transmitted automatically when there is a change.	

Cyclical (0 = inactive)	**0**...255 min
This parameter determines whether the setpoint temperature is to be transmitted cyclically via the "Setpoint temperature" object. Definition of the cycle time by this parameter. In the "0" setting, the setpoint temperature is not transmitted cyclically.	

11.2.4.12 Objects for operating mode and setpoints

Function	Name	Type	DPT	Flag
Operating mode - Pre-set	RTC .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for change-over of the operating mode of the controller according to the KNX specification. After mains voltage return or an ETS programming operation, the current operating mode is transmitted via this object.				

Function	Name	Type	DPT	Flag
Operating mode - Pre-set - Status	RTC .. - Output	1-byte	20,102	C, R, -, T, A
1-byte object for indicating the current operating mode.				

Function	Name	Type	DPT	Flag
Operating mode - Forced	RTC .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for forced change-over (highest priority) of the operating mode of the controller according to the KNX specification.				

Function	Name	Type	DPT	Flag
Operating mode - Forced - Status	RTC .. - Output	1-byte	20,102	C, R, -, T, A
1-byte object for indicating the forced operating mode.				

Function	Name	Type	DPT	Flag
Presence detection - Presence button	RTC .. - Input	1-bit	1,001	C, -, W, T, U
1-bit object through which an external presence button (e.g. from a controller extension) can be linked to the controller (polarity: Presence exists = "1", no presence exists = "0"). Presence allows permanent switching to Comfort mode (starting in Standby mode) or temporary switching to this comfort extension (starting from Night mode or Frost/heat protection mode). Presence in Standby mode: If there is a presence, the controller activates Comfort mode. As soon as the object no longer signals a presence, the controller switches back to Standby mode. Presence in Night mode or Frost/heat protection mode: If there is a presence, the controller activates the comfort extension. After the configured length of the comfort extension has elapsed, the system automatically switches back to Night mode or Frost/heat protection mode. In this case, the object value is reset automatically. After mains voltage return or an ETS programming operation (controller reset), the presence function is always inactive. This object is only visible when presence detection is configured to "Presence button".				

Function	Name	Type	DPT	Flag
Presence detection - Presence object 1	RTC .. - Input	1-bit	1,001	C, -, W, -, U
Presence detection - Presence object 2	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object through which an external KNX presence detector can be linked to the controller (polarity: Presence exists = "1", no presence exists = "0"). If there is a presence, the controller activates Comfort mode, provided that no higher-level function (e.g. window status) is active. The controller switches to the last specified operating mode as soon as the presence detector ceases to signal a presence. After mains voltage return or an ETS programming operation (controller reset), the presence function is always inactive. These objects are only visible when presence detection is configured to "Presence detector".				

Function	Name	Type	DPT	Flag
Frost/heat protection - Window contact	RTC .. - Input	1-bit	1,019	C, -, W, -, U
1-bit object for the coupling of window contacts. Polarity: Window open = "1", window closed = "0".				

Function	Name	Type	DPT	Flag
Frost/heat protection - Window contact - Status	RTC .. - Output	1-bit	1,011	C, -, W, T, U
1-bit object for the message of window contacts. Polarity: Window open = "1", window closed = "0".				

Function	Name	Type	DPT	Flag
Frost protection - Temperature drop - Status	RTC .. - Output	1-bit	1,011	C, R, -, T, A
1-bit object to signal a detected temperature drop. Polarity: temperature drop detected = "1", no temperature drop detected = "0".				

Function	Name	Type	DPT	Flag
Setpoint temperature - Active operating mode - Status	RTC .. - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the output of the current temperature setpoint. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The temperature value is always output in the format "°C". After mains voltage return or an ETS programming operation (controller reset), the current setpoint temperature is transmitted via this object.				

Function: absolute setpoint temperature specification

Function	Name	Type	DPT	Flag
Setpoint temperature - Active operating mode	RTC .. - Input	2-byte	9,001	C, -, W, -, U
2-byte object for external setting of a setpoint for absolute setpoint presetting. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received via the object to 0.1 K. The temperature value must always be specified in the format "°C".				

Function: relative setpoint temperature specification, basic value

Function	Name	Type	DPT	Flag
Setpoint temperature - Basic value	RTC Input	2-byte	9,001	C, -, W, -, U
2-byte object for external specification of the basic setpoint for relative setpoint specification. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The temperature value must always be specified in the format "°C".				

Function	Name	Type	DPT	Flag
Setpoint temperature - Basic value - Status	RTC - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the output of the current basic setpoint. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The temperature value is always output in the format "°C". After mains voltage return or an ETS programming operation (controller reset), the current basic setpoint temperature is transmitted via this object.				

Function: relative setpoint temperature shift via relative temperature value

Function	Name	Type	DPT	Flag
Setpoint temperature - Shift	RTC Input	2-byte	9,002	C, -, W, -, U
2-byte object for specifying a setpoint temperature shift, e.g. via a room temperature control point. The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. In case the limits of the value range are exceeded by the preset external value, the controller will automatically reset the received value to the minimum and maximum limits.				

Function	Name	Type	DPT	Flag
Setpoint temperature - Shift - Status	RTC - Output	2-byte	9,002	C, R, -, T, A
2-byte object for giving feedback on the current setpoint temperature shift for evaluation, e.g. by a room temperature control point. The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. After mains voltage return or an ETS programming operation (controller reset), the current value for the basic setpoint temperature shift is transmitted via this object. Since the value for the basic setpoint temperature shift is stored exclusively in a volatile memory, the shift is always "0" immediately after a mains voltage return or an ETS programming operation.				

Function: relative setpoint temperature shift via counter value x step width

Function	Name	Type	DPT	Flag
Setpoint temperature - Shift	RTC Input	1-byte	6,010	C, -, W, -, U
1-byte object for specifying a basic setpoint shift, e.g. via a room temperature control point. The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. In case the limits of the value range are exceeded by the preset external value, the controller will automatically reset the received value to the minimum and maximum limits.				

Function	Name	Type	DPT	Flag
Setpoint temperature - Shift - Status	RTC - Output	1-byte	6,010	C, R, -, T, A
1-byte object for giving feedback on the current setpoint shift for evaluation, e.g. by a room temperature control point. The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. After mains voltage return or an ETS programming operation (controller reset), the current value for the basic setpoint shift is transmitted via this object. Since the value for the basic setpoint shift is stored exclusively in volatile memory, the shift is always "0" immediately after a mains voltage return or an ETS programming operation.				

11.2.5 Command value output and command value limit

Automatic transmission

On automatic transmission of the command value telegrams, a distinction is made with regard to the type of control...

- Continuous PI control:
  In the case of continuous PI control, the room temperature controller calculates a new command value cyclically every 30 seconds and outputs it to the bus via a 1-byte value object. In so doing, the parameter "On change by (0 = inactive)" in the parameter node "Room temperature controller -> RTC - General -> Command value output" can be used to specify the change interval of the command value in percent, according to which a new command value is to be output to the bus. The change interval can be configured to "0" so that a change in the command value will not result in an automatic transmission.
  In addition to the command value output following a change, the current command value may be periodically transmitted. In addition to the times when changes are to be expected, other command value telegrams will be output according to the active value after a configurable cycle time. This ensures that, during cyclical security monitoring of the command value in valve drive or in the addressed switch actuator, telegrams are received within the monitoring time. The time interval defined by the parameter "Cyclical (0 = inactive)" should correspond to the monitoring time in the actuator (cycle time in the controller is preferably to be configured smaller). The "0" setting will deactivate the periodic transmission of the command value.
  With continuous PI control it must be noted that if the cyclical and the automatic transmission are both deactivated, no command value telegrams will be transmitted in case of a change!
- Switching PI control (PWM):
  In case of a switching PI control (PWM), the room temperature controller calculates a new command value internally every 30 seconds. The parameter "PWM cycle time" defines the cycle time of the PWM command value signal.

  If the command value is changed, the current PWM cycle is adapted as required so that the duty factor corresponds as directly as possible to the new command value. This adaptation is carried out in the same way as for activation of the valve outputs.
- 2-point feedback control:
  In case of a 2-point feedback control, the room temperature and thus the hysteresis values are evaluated periodically every 30 seconds, so that the command values, if required, will change solely during these times. As, with this control algorithm, no continuous command values are calculated, the parameter "On change by (0 = inactive)" has no effect with this control algorithm.
  In addition to the command value output following a change, the current command value may be periodically transmitted on the bus. In addition to the times when changes are to be expected, other command value telegrams will be output according to the active value after a configurable cycle time. This ensures that, during cyclical security monitoring of the command value in valve drive or in the addressed switch actuator, telegrams are received within the

monitoring time. The time interval defined by the parameter "Cyclical (0 = inactive)" should correspond to the monitoring time in the actuator (cycle time in the controller is preferably to be configured smaller). The "0" setting will deactivate the periodic transmission of the command value.

Command value limit

Optionally a command value limit can configured in the ETS. The command value limit allows the restriction of calculated command values to the range limits "Minimum command value" and "Maximum command value". The limits are permanently set in the ETS and, if command value limitation is active, can be neither undershot or exceeded during device operation. It is possible, if available, to specify various limiting values for the basic and additional stages and for heating and cooling.

The "Activation" parameter on the parameter page "Room temperature controller -> RTC - General -> Command value limit" defines the type of action of the limiting function. The command value limit can either be activated or deactivated using the 1-bit communication object "Command value limit", or be permanently active. When controlling via the object, it is possible to have the controller activate the command value limit automatically after bus voltage return or an ETS programming operation. Here, the "Active after reset" parameter defines the initialisation behaviour. In the "No" setting, the command value limit is not automatically activated after a device reset. A "1" telegram must first be received via the "Command value limit" object for the limit to be activated. In the "Yes" setting, the controller activates the command value limit automatically after a device reset. To deactivate the limit a "0" telegram must be received via the "Command value limit - Activate / Deactivate" object. The limit can be switched on or off at any time using the object.
With a permanently active command value limit, the initialisation behaviour cannot be configured separately after a device reset, as the limit is always active. In this case it is also not possible to configure any object.

As soon as the command value limit is active, calculated command values are limited according to the limiting values from the ETS. The behaviour with regard to the minimum or maximum command value is then as follows...

- Minimum command value:
  The "Minimum command value" parameter specifies the lower command value limiting value. The setting can be made in 5% increments in the range 5% ... 50% can be made. With an active command value limit, the set minimum command value is not undershot by command values. If the controller calculates smaller command values, it sets the configured minimum command value. The controller transmits a 0% command value if no more heating or cooling energy has to be demanded.
- Maximum command value:
  The "Maximum command value" parameter specifies the upper command value limiting value. The setting can be made in 5% increments in the range 55% ... 100% can be made. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.

If the limit is removed, the device automatically repositions the most recently calculated command value to the unlimited values when the next calculation interval for the command values (30 seconds) has elapsed.

- An active command value limit has a negative effect on the control result when the command value range is very restricted. A control deviation must be expected.

Special case for command value 100% (Clipping mode)

If with a PI control the calculated command value of the controller exceeds the physical limits of the actuator, in other words if the calculated command value is greater than 100%, then the command value is set to the maximum value (100%) and thus limited. This special, necessary control behaviour is also called "clipping". With PI control the command value can reach the value "100%" if there is a large deviation of the room temperature from the setpoint temperature or the controller requires a long time to adjust to the setpoint with the heating or cooling energy that is being applied. The controller evaluates this state in a particular manner.

The controller maintains the maximum command value only as long as it is necessary. After that it adjusts the command value downwards according to the PI algorithm. The advantage of this control characteristic is the fact that the room temperature does not exceed the setpoint temperature at all, or only slightly. It should be mentioned that this necessary control principle increases the tendency to oscillate about the setpoint.

- Clipping may also occur when a command value limit is active (maximum command value). In this case, if the internally calculated command value reaches 100%, then the controller only transmits to the bus the maximum command value according to the ETS configuration.

11.2.5.1 Command value output parameters

Room temperature controller .. -> RTC .. - General -> Command value output

PWM cycle time	1 ... **15** ... 255 min
This parameter specifies the cycle time for the pulse width modulated command value (PWM).	

Heating	**Normal (under current, this means opened)** Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured and not two-level operation.	

Basic level heating	**Normal (under current, this means opened)** Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the basic level heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured along with two-level operation.	

Additional level heating	**Normal (under current, this means opened)** Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the additional level heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured along with two-level operation.	

Cooling	**Normal (under current, this means opened)** Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured and not two-level operation.	

Basic level cooling	Normal (under current, this means opened) Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the basic level cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured along with two-level operation.	

Additional level cooling	Normal (under current, this means opened) Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the additional level cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured along with two-level operation.	

Basic level heating / cooling	Normal (under current, this means opened) Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the heating / cooling basic level is output normally or in inverted form. This parameter is only visible if the operating mode "Basic and additional heating and cooling" is configured.	

Additional level heating / cooling	Normal (under current, this means opened) Inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the heating / cooling additional level is output normally or in inverted form. This parameter is only visible if the operating mode "Basic and additional heating and cooling" is configured.	

Transmission behaviour

On change by (0 = inactive)	0...3...100 %
This parameter determines the size of the command value change that will automatically transmit continuous command value telegrams via the command value objects. Thus this parameter only affects command values which are configured to "Continuous PI control" and to the 1-byte additional command value objects of the "Switching PI control (PWM)".	

Cyclical	0...10...255 min
This parameter determines the time interval for the cyclical transmission of the command values via all command value objects.	

11.2.5.2 Command value limit parameters

Room temperature controller .. -> RTC .. - General -> Command value limit

Activation	**Via object** Permanently active

The command value limit allows the restriction of calculated command values to the range limits "minimum" and "maximum". The limits are permanently set in the ETS and, if command value limitation is active, can be neither undershot or exceeded during device operation.
The "Activation" parameter defines the type of action of the limiting function. The command value limit can either be activated or deactivated using the 1-bit communication object "Command value limit - Activate / Deactivate" or be permanently active.

Active after reset	Active **Inactive**

When controlling via the object, it is possible to have the controller activate the command value limit automatically after bus voltage return or an ETS programming operation. This parameter defines the initialisation behaviour here.
In the "Deactivated" setting, the command value limit is not automatically activated after a device reset. A "1" telegram must first be received via the "Command value limit - Activate/Deactivate" object for the limit to be activated.
In the "Activated" setting, the controller activates the command value limit automatically after a device reset. To deactivate the limit a "0" telegram must be received via the "Command value limit - Activate / Deactivate" object. The limit can be switched on or off at any time using the object.
This parameter is only visible if the command value limit can be activated via object.

Heating (also for basic level or additional level)

Minimum command value	**5%**, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%

The "Minimum command value" parameter specifies the lower command value limiting value for heating. With an active command value limit, the set minimum command value is not undershot by command values. If the controller calculates smaller command values, it sets the configured minimum command value. The controller transmits a 0% command value if no more heating or cooling energy has to be demanded.

Maximum command value	55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, **95%**, 100%

The "Maximum command value" parameter specifies the upper command value limiting value for heating. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.

Cooling (also for basic level or additional level)

Minimum command value	**5%**, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%
The "Minimum command value" parameter specifies the lower command value limiting value for cooling. With an active command value limit, the set minimum command value is not undershot by command values. If the controller calculates smaller command values, it sets the configured minimum command value. The controller transmits a 0% command value if no more heating or cooling energy has to be demanded.	

Maximum command value	55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, **95%**, 100%
The "Maximum command value" parameter specifies the upper command value limiting value for cooling. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.	

11.2.5.3 Objects for command value output and command value limit

Object for heating command value output and combined valve heating/cooling

Function	Name	Type	DPT	Flag
Command value - Basic level heating	RTC .. - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the continuous command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Basic level heating	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the PWM command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Basic level heating - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object for additional continuous output for the PWM command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Basic level heating	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the switching command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Function	Name	Type	DPT	Flag
Command value - Basic heating/cooling level	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the combined continuous command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Basic heating/cooling level	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the combined PWM command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Heating/cooling command value - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-bit object for additional continuous output of the PWM command value of heating and cooling mode. In two-level heating and cooling mode, command value output for basic heating / basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Basic heating/cooling level	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the combined switching command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching 2-point feedback control".				

Object for command value output, additional heating and combined valve additional heating/cooling

Function	Name	Type	DPT	Flag
Command value - Additional level heating	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the continuous command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the continuous PWM command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-bit object for additional continuous output for the PWM command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the switching command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating/cooling	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the combined continuous command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating/cooling	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the combined switching PWM command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating/cooling - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-bit object for additional continuous output of the combined command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Additional level heating/cooling	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the combined switching command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching 2-point feedback control".				

Object for command value output, cooling

Function	Name	Type	DPT	Flag
Command value - Basic level cooling	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the continuous command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Basic level cooling	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the PWM command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Basic level cooling - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-bit object for additional continuous output of the PWM command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Basic level cooling	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the switching command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Object for command value output, additional cooling

Function	Name	Type	DPT	Flag
Command value - Additional level cooling	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object to output the continuous command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Continuous PI control".				

Function	Name	Type	DPT	Flag
Command value - Additional level cooling	RTC - Output	1-bit	1,001	C, R, -, T, A
1-bit object to output the continuous PWM command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value - Additional level cooling - Status	RTC - Output	1-byte	5,001	C, R, -, T, A
1-byte object for additional continuous output of the PWM command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".				

Function	Name	Type	DPT	Flag
Command value limit - activate / deactivate	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activating or deactivating the command value limit.				

11.2.6 Room temperature input

Basic principles

The controller operates with the controller input temperature according to the source of the room temperature, which is transmitted to the controller either by the internal temperature measurement of the device and/or by a received temperature via the bus.

According to KNX DPT 9.001, the received temperature must be made available to the controller in the format "°C".

When selecting the mounting location of the external temperature sensor, the following points must be considered:

- The temperature sensor should not be used in multiple combinations, especially together with flush-mounted dimmers.
- Do not install the temperature sensor in the area of large electrical consumers (avoid heat influences).
- Installation in the vicinity of radiators or cooling systems is not advisable.
- The temperature sensor should not be exposed to direct sun.
- The installation of sensors on the inside of an outside wall might have a negative impact on the temperature measurement.
- Temperature sensors should be installed at least 30 cm away from doors, windows or ventilation devices and at least 1.5 m above the floor.

Calibrating the measured values

In some cases during room temperature measurement, it may be necessary to adjust the temperature values. Adjustment becomes necessary, for example, if the temperature measured by the sensors stays permanently below or above the actual temperature in the vicinity of the sensor. To determine the temperature deviation, the actual room temperature should be detected with a reference measurement using a calibrated temperature measuring device.

ℹ The adjustment of the measured values should only be carried out after the device has become acclimatised in the installation environment. It is recommended to carry out the adjustment approx. 1.5 hours after commissioning. Direct sunlight penetration should be avoided.

Using the "Adjustment" parameters, it is possible to configure the positive (temperature increase, factors: 1 ... 127) or negative (temperature decrease, factors -128... -1) temperature calibration in levels of 0.1 K. Thus, the calibration is made only once statically and is the same for all operating modes of the controller.

ℹ The measured value has to be increased, if the value measured by the sensor lies below the actual room temperature. The measured value has to be decreased, if the value measured by the sensor lies above the actual room temperature.

i During room temperature control, the device always uses the adjusted temperature value to calculate the command values. The adjusted temperature value is transmitted to the bus via the "Actual temperature" object. When determining the measured value, calibrated values are also used for calculation.

Transmission of room temperature

The determined actual temperature can be actively transmitted to the bus via the 2-byte object "Room temperature - Actual value - Status". Parameter "On change by" specifies the temperature value by which the actual value has to change in order to have the actual temperature value automatically transmitted via the object. Possible temperature value changes lie within a range of 0.1 K and 25.5 K.

In addition, the actual value can be transmitted periodically. The cyclical transmission of the room temperature parameter determines the cycle time (1 to 255 minutes). The value "0" will deactivate the periodical transmission of the actual temperature value. If the "Read" flag is set at the "Room temperature - actual value" object, this makes it possible to read out the current actual value at any time via the bus. It has to be pointed out that with deactivated periodical transmission and deactivated automatic transmission, no more actual-temperature telegrams will be transmitted".

Following a bus voltage return or after programming via the ETS, the object value will be updated according to the current actual temperature value and transmitted as soon as all the external temperature values of the KNX sensors have been received. As long as no external temperature values have been received after a reset, then the value "0" is indicated in the "Room temperature - actual value" object. For this reason, all the external temperature sensors should always transmit their current measured temperature value after a reset!

During room temperature control, the controller always uses the calibrated temperature values to calculate the command values. The calibrated temperature values can be actively transmitted on the bus via the "Room temperature - actual value" object.

Input temperature controller and measuring value creation

The "Source of room temperature" parameter specifies the temperature at which the room temperature controller operates.

– "internal temperature"

  The room temperature controller uses the actual temperature of the temperature measurement determined by the device. The temperature value is transmitted internally in the device.

  The room temperature controller can request the current temperature value cyclically.

  After a device reset the controller will first wait for a valid temperature telegram until the feedback control starts and a command value, if applicable, is output.

First activate the temperature measurement on parameter page "General" and configure it on the parameter page "Temperature measurement".

– "received temperature"

The room temperature controller uses the temperature value received via the communication object "Received temperature".

The room temperature controller can request the current temperature value cyclically.

After a device reset the controller will first wait for a valid temperature telegram until the feedback control starts and a command value, if applicable, is output.

The room temperature controller uses the temperature value received via the communication object "Received temperature".

– "internal and received temperature"

  The room temperature controller uses the actual temperature of the temperature measurement determined by the device and transmitted internally, and the temperature value received via the communication object "Received temperature".

  When evaluating, the real temperature used is made up of the two temperature values provided. The weighting of the temperature values is defined by the parameter "Weighting of temperatures". It is thus possible to adjust the temperature used by the room temperature controller depending on the different locations of the sensors or due to a non-uniform heat distribution in the room. Temperature sensors that are subject to negative external influences (for example, unfavourable location because of exposure to sun or radiator or door/window in the immediate vicinity) are often weighted less heavily.

  The room temperature controller can request both current temperature values cyclically.

  After a device reset, the controller will first wait for valid temperature telegrams until control starts and a command value, if applicable, is output.

First activate the temperature measurement on parameter page "General" and configure it on the parameter page "Temperature measurement".

Example: A temperature sensor has been installed next to the entrance door (internal sensor). An additional temperature sensor has been mounted on an inner wall in the middle of the room below the ceiling.
Internal temperature: 21.5 °C
Received temperature: 22.3 °C
Weighting of the temperatures: 30% to 70%

-> $T_{\text{Result internal}} = T_{\text{internal}} = 21.5\ °C \cdot 0.3 = 6.45\ °C$,
-> $T_{\text{Result 2}} = T_2 = 22.3\ °C \cdot 0.7 = 15.61\ °C$
-> $T_{\text{Result}} = T_{\text{Result 1}} + T_{\text{Result 2}} = \underline{22{,}06\ °C}$

Monitoring the actual temperature

The cyclical actual temperature monitoring can be activated or deactivated via parameter. The "Cyclical monitoring of the temperature inputs" parameter activates or deactivates this function. The cycle time can be configured by parameter and applies equally to all temperature inputs.

If the value is not updated within the cycle time at the configured temperature input, the controller indicates this error case via the KNX-compliant controller status RHCC. Correspondingly, bit 0 ("0" = No error / "1" = Error) of the status telegram (object "Controller status RHCC - KNX-compliant) can be evaluated.

The controller remains active even when no input temperature values are received. The basic levels and the additional levels work with the last received temperature value and continue outputting command values.

The error status is cancelled when a configured temperature input is updated within a cycle period. Then the status telegram is also updated and transmitted.

11.2.6.1 Temperature measurement parameters

Room temperature input

Room temperature source	**Internal temperature** Received temperature Internal and received temperature

The controller operates with the controller input temperature, which is transmitted to the controller either by the internal temperature measurement of the device and / or by a received temperature via the bus.

– Internal temperature: The room temperature controller uses the actual temperature of the temperature measurement determined by the device. The temperature value is transmitted internally in the device.

i First activate the temperature measurement on parameter page "General" and configure it on the parameter page "Temperature measurement".

– Received temperature: The room temperature controller uses the temperature value received via the communication object "Received temperature".

i The room temperature controller uses the temperature value received via the communication object "Received temperature".

– Internal and received temperature: The room temperature controller uses the actual temperature of the temperature measurement determined by the device and transmitted internally, and the temperature value received via the communication object "Received temperature".

i First activate the temperature measurement on the "General" parameter page and configure it on the "Room temperature measurement" parameter page.

Weighting of the temperatures	10% to 90% 20% to 80% 30% to 70% 40% to 60% **50% to 50%** 60% to 40% 70% to 30% 80% to 20% 90% to 10%

The weighting of the temperature values "internal temperature" to "received temperature" is determined here. That results in an overall value, which will be used for the further interpretation of the room temperature.

Cyclical polling of the temperature values	**Inactive** Active

Here, cyclical querying of the temperature values can be enabled as an option ("Active" setting). If, during active cyclical monitoring, there are no temperature values during the cycle time defined by the parameter of the same name, emergency operation will be activated.

Cycle time	**0** ... 4 h | 1 ... **20** ... 59 min
Presetting of the monitoring time hours and minutes.	

Cyclical polling of the temperature values	**Inactive** Active
This setting determines whether the controller polls the temperature value(s) cyclically. In the "Inactive" setting, the temperature value is not automatically polled by the controller. In this case the communication partner (e.g. controller extension) must transmit its temperature value itself.	

Cycle time	1 ... **10**... 255
The polling time for the external temperature value(s) is specified here.	

Temperature calibration

Adjust the received temperature to	-12.8...**0**...12.7 K
Determines the value by which the room temperature measured value of the received temperature value is calibrated.	

Room temperature transmission behaviour

On change by (0 = inactive)	0...**0.5**...25.5 K
This parameter specifies the temperature value by which the actual value has to change in order to have the actual temperature value transmitted automatically via the object. The "0" setting deactivates the automatic transmission of the actual temperature.	

Cyclical (0 = inactive)	0...**15**...255 min
This parameter specifies whether and when the determined room temperature is output cyclically via the "Actual temperature" object.	

11.2.6.2 Objects for temperature measurement

Function	Name	Type	DPT	Flag
Room temperature - Actual value - Status	RTC - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the display of the actual temperature active in the controller (room temperature). The possible temperature range is specified by the received temperature values and corresponds to the range specified by the KNX DPT 9.001. The temperature value is always output in the format "°C".				

Function	Name	Type	DPT	Flag
Room temperature - Received temperature	RTC Input	2-byte	9,001	C, -, W, T, U
2-byte object for coupling an external KNX temperature sensor (e.g. push-button sensor with temperature measurement) for room temperature detection. The possible temperature range is specified by the KNX DPT 9.001. The temperature value must always be specified in the format "°C".				

11.2.7 Controller status

The room temperature controller can transmit its current status to the KNX. A choice of data formats is available for this. The parameter "Status" in the parameter node "RTC .. - General -> Enable" enables the Status parameter page. The different status objects can be activated there individually.

- The KNX-compliant controller status feedback is harmonised on a manufacturer-independent basis.
- The objects "Controller status RHCC - KNX compliant", "Controller status RTC - KNX compliant" and "Controller status RTSM - KNX compliant" display elementary basic functions of the controller.
- These objects are supplemented by the two 1-byte objects "Operating mode status" and "Forced operating mode status" (DPT 20.102), which report back the operating mode actually set at the controller. The last two objects mentioned above are generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore, these objects should be connected with controller extensions if the KNX-compliant status feedback is not configured.

Bit coding of the 2-byte object "Controller status - RHCC" (DPT 22.101)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Error	No error
1	not used (permanent "0")	
2	not used (permanent "0")	
3	not used (permanent "0")	
4	not used (permanent "0")	
5	not used (permanent "0")	
6	not used (permanent "0")	
7	not used (permanent "0")	
8	"Heating" operating mode	"Cooling" operating mode
9	not used (permanent "0")	
10	not used (permanent "0")	
11	not used (permanent "0")	
12	Controller disabled (dew point operation)	Controller enabled
13	Frost alarm (frost protection temperature undershot)	No frost alarm (frost protection temperature exceeded)
14	Heat alarm (heat protection temperature exceeded)	No heat alarm (heat protection temperature undershot)
15	not used (permanent "0")	

Bit coding of the 2-byte object "Controller status - RTC" (DPT 22.101)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Error	No error
1	"Heating" operating mode	"Cooling" operating mode
2	Controller disabled (dew point operation)	Controller enabled
3	Frost alarm (frost protection temperature undershot)	No frost alarm (frost protection temperature exceeded)
4	Heat alarm (heat protection temperature exceeded)	No heat alarm (heat protection temperature undershot)
5	Controller inactive (deadband)	Controller active
6	not used (permanent "0")	
7	"Heating" operating mode enabled	"Heating" operating mode disabled
8	"Cooling" operating mode enabled	"Cooling" operating mode disabled
9	not used (permanent "0")	
10	not used (permanent "0")	
11	not used (permanent "0")	
12	not used (permanent "0")	
13	not used (permanent "0")	
14	not used (permanent "0")	
15	not used (permanent "0")	

Bit coding of the 1-byte object "Controller status - RTSM" (DPT 21.107)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Window opened (For "Frost/heat protection = automatic frost protection": – The bit is active if the automatic frost protection of the temperature drop detection is active. For "Frost/heat protection = via window status": – The bit is active if at least one window is open after the delay time has elapsed.)	No window opened (For "Frost/heat protection = automatic frost protection": – The bit is inactive if the automatic frost protection of the temperature drop detection is inactive. For "Frost/heat protection = via window status": – The bit is inactive if all windows are closed.)
1	Presence (Presence detector)	No presence (Presence detector)
2	Presence (Presence button)	No presence (Presence button)
3	Comfort extension active	Comfort extension inactive

Bit of the status telegram	Meaning on "1"	Meaning on "0"
4	Forced operating mode active	Forced operating mode inactive
5	not used (permanent "0")	
6	not used (permanent "0")	
7	not used (permanent "0")	

Bit 0 of the 1-byte object "Controller status RTSM" (DPT 21.107) becomes active, depending on the setting of the parameter "Frost/heat protection".

Heating/cooling message

Depending on the set operating mode, separate objects can be used to indicate whether the controller is currently demanding heating or cooling energy and is thus actively heating or cooling. As long as the heating command value is > "0", a "1" telegram will be transmitted via the object "Heating status object". The signal telegram is only reset when the command value is "0" ("0" telegram is transmitted). The same applies to the object "Cooling status object".

The signal objects can be enabled by the "Heating status object" or "Cooling status object" parameters in the parameter branch "Room temperature controller .. -> RTC .. - General -> Status". The control algorithm controls the signal objects. Please note that the command values are recalculated every 30 s, thus updating the signal objects.

11.2.7.1 Status parameters

Heating / Cooling (depending on the operating mode of the controller)

Status object - Heating	Active Inactive
Depending on the set operating mode, a separate object can be used to signal whether the controller is currently demanding heating energy and is thus actively heating. The "Active" setting here enables the message function for heating.	

Status object - Cooling	Active Inactive
Depending on the set operating mode, a separate object can be used to signal whether the controller is currently demanding cooling energy and is thus actively cooling. The "Active" setting here enables the message function for cooling.	

Controller status

Status objects - Operating mode	Active Inactive
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the objects "Operating mode - Preset - Status", "Operating mode - Active mode - Status" and "Operating mode - Forced - Status" are visible.	

Status object - RHCC	Active Inactive
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RHCC" is visible.	

Status object - RTC	Active Inactive
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RTC" is visible.	

Status object - RTSM	Active Inactive
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RTSM" is visible.	

11.2.7.2 Objects for controller status

Function	Name	Type	DPT	Flag
Operating mode - Pre-set - Status	RTC - Output	1-byte	20,102	C, R, -, T, A

1-byte object used by the controller to output the current operating mode. This object is generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore this object should be connected with controller extensions if the KNX compliant status feedback is not configured.

After mains voltage return or an ETS programming operation, the current status is transmitted via this object. This object is only available if the parameter "Status objects - operating mode" is activated.

Function	Name	Type	DPT	Flag
Operating mode - Active mode - Status	RTC - Output	1-byte	20,102	C, R, -, T, A

1-byte object used by the controller to output the current operating mode, taking the forced position, presence status and window status into account. This object is only available if the parameter "Status objects - operating mode" is activated.

Function	Name	Type	DPT	Flag
Operating mode - Forced - Status	RTC - Output	1-byte	20,102	C, R, -, T, A

1-byte object used by the controller to output the operating mode in the event of restraint. This object is generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore this object should be connected with controller extensions if the KNX compliant status feedback is not configured.

After mains voltage return or an ETS programming operation, the current status is transmitted via this object. This object is only available if the parameter "Status objects - operating mode" is activated.

11.2.8 Fan controller

Introduction

The room temperature control can be supplemented with a fan controller. This makes it possible to control the fan from heating and cooling systems operated by circulating air, such as fan coil units, depending on the command value calculated in the controller or using manual operation.

On the parameter page "Room temperature controller .. -> RTC .. General -> Fan control", the fan control can be configured.

The fan control distinguishes between automatic and manual operation.

The icon is visible on the display.

After a device reset, the device switches to an operating mode depending on the parameters ("Operating mode after reset"). The setting of the parameter "Fan controller available" in combination with the "Operating mode after reset" configures the fan control after a device reset. Fan control is active in automatic mode after a device reset if the "Operating mode after reset" parameter is set to "Comfort mode".

11.2.8.1 Operating mode and fan levels

The room temperature control can be supplemented with a fan controller. This makes it possible to control the fan from heating and cooling systems operated by circulating air, such as fan coil units, depending on the command value calculated in the controller or using manual operation.

If necessary, the fan controller can be enabled separately by the "Fan controller available" parameter in the parameter node "Room temperature control .. -> RTC .. - General" be enabled via a checkbox. If the function is enabled, further parameters appear in the ETS in the parameter node "Room temperature controller .. -> RTC .. - General -> Fan control" and additional communication objects.

If the fan control is enabled, the icon becomes visible in the display after the device is commissioned.

ℹ The fan controller works only in conjunction with PI feedback controls with continuous or switching (PWM) command value output. In 2-point feedback control, the fan controller is inactive, even if the function is enabled in the ETS.

Depending on the operating mode of the room temperature control, as configured in the ETS, various controller command values can be used as the basis for fan control. The "Fan operating mode" parameter specifies which command value of the controller controls the fans. With one-level room temperature control, it is possible to select whether the fan is activated during heating and/or during cooling. With two-level room temperature control, it is also possible for the fan controller to be set to the basic level or the additional level during heating and cooling.

ℹ However, under no circumstances is it possible to use the basic and additional levels simultaneously for a fan controller within an operating mode.

Fan coil units are as a rule equipped with filters, and have multi-level fans whose speed and thus ventilation output can be varied by means of fan level inputs. For this reason, the fan controller of the room temperature controller supports up to 8 fan level outputs, for which the actually used number of levels (1...8) is set using the "Number of fan levels" parameter.

The controller controls the levels of a fan using bus telegrams. Usually, the fan level telegrams are received and evaluated by simple switching actuators. The electrical control of the fan level inputs of a fan coil unit takes place via these actuators. Depending on the data format of the objects of the controlled actuators, the change-over between the fan levels can either take place via up to 8 separate 1-bit objects or, alternatively, via one 1-byte object. The "Fan level change-over via" parameter defines the data format of the controller. With the 1-bit objects, each fan level receives its own object. With the 1-byte object, the active fan level is expressed by a value.

Fan level	Object value
Fan OFF	0
1	1
2	2
3	3
4	4
5	5
5	6
7	7
8	8

Due to fan motors' inertia, as a rule there is a limit to how short the time intervals for switching the fan levels can be, i.e. there is a limit to how quickly the fan speed can be varied.

i Often the technical information for a fan coil unit specifies change-over times that the fan controller must maintain for each fan level change-over. The switchover direction, i.e. whether the level is increased or decreased, is irrelevant.

With a change-over via the 1-bit objects, when the fan level is changed by the controller, the active fan level is first switched off before the new level is switched on. If the fan controller is working in automatic mode, the settable "Waiting time on level change-over" is maintained on change-over of the levels. For this short time, the fan level objects all receive the status "0 - Fan off". A new level is only then switched on when the waiting time has elapsed. Only one fan level output is ever switched on (changeover principle).

With change-over via the 1-byte object, on changing the fan level, the change-over takes place directly into the new level, without setting the "OFF" status. If the fan controller is working in automatic mode, the settable "Waiting time on level change-over" (dwell time) is always taken into account before change-over of the levels. With rapid level change-over, the change to the new level only takes place once the waiting time has elapsed.

The change from level 1 to OFF always takes place immediately, without a waiting time. An optional, configured start-up level is applied directly.

In manual mode, the "Waiting time on level switchover" is only significant for the start-up level (Start-up via level). Here, the fan levels can be switched over without a delay through manual operation.

When changing from manual operation to automatic operation, the waiting time is taken into account in the case of a connected level change.

The fan level active in the current controller operating state is shown with using the fan icon in the display of the device. In both automatic and manual operation the indication takes place via arc segments in the fan icon in the following manner...

Fan OFF

Fan level 1 active

Fan level 2 active

Fan level 3 active

Fan level 4 active

Fan level 5 active

Fan level 6 active

Fan level 7 active

Fan level 8 active

With up to 8 fan levels each individual fan level is identified in the fan icon by an individual arc segment. The arc is closed when all 8 fan levels are switched on.
If the number of fan levels is reduced in the ETS (e.g. "3"), adjacent arc segments are joined into groups, so that, when the largest fan level ("3" -) is activated, all of the arc segments of the fan icon are illuminated. For smaller fan levels, fewer group segments are illuminated in like manner ("2" - / "1" -).

The fans of a fan coil unit are - as described above - controlled by the fan level objects of the controller. The electromechanical valves for heating and/or cooling, integrated in the fan devices, can be controlled via suitable switch actuators using the objects "Heating - status" or "Cooling - status".

The 1-byte object "Ventilation - fan level visualisation" can, if necessary, also be evaluated by other KNX devices (e.g. visualisation - panel / PC software). It always transmits the current fan level as a 1-byte value, either automatically on a change or passively on reading out.

ℹ The objects of the fan levels are only updated by the controller. These objects may not be written to by other bus subscribers. Reading out is possible.

ℹ After a device reset, the fan level objects and the visualisation objects are updated and the status transmitted on the bus.

11.2.8.2 Automatic operation / manual operation

The fan control distinguishes between automatic and manual operation.

Switching over between the two operating modes takes place using the 1-bit object "Auto/manual - toggle", through the operation of an extension or push-button sensor configured for "Room temperature controller control point -> Fan control auto/manual".

The parameter "Object polarity" on the fan output parameter page defines with which switching value automatic or manual operation is set via the communication object.

ℹ The "Auto/manual - toggle" object transmits actively ("Transmit" flag set). When the operating mode is changed over using local control, the valid status is transmitted to the bus.

ℹ Updates to the object value "Automatic mode active" -> "Automatic mode active" or "Manual mode active" -> "Manual mode active" do not produce any reaction.

Automatic mode:

The command value of the controller is used internally in the device for automatic control of the fan levels. As a transition between the levels, there are threshold values, defined according to the command value of the controller, which can be set using parameters in the ETS. If the command value reaches the threshold value of a level during an increase of the command value, the appropriate level is activated. If the command value reaches below a threshold value, minus the configured hysteresis, during a reduction of the command value, then the switchover takes place into the next lowest fan level. The "Hysteresis between thresholds" value applies to all the threshold values.

The threshold values for the individual fan levels can be configured freely in the range from 1 ... 100 % can be configured.

ℹ The threshold values are not checked for plausibility in the ETS, meaning that incorrect configuration is possible. For this reason, it must be ensured that the threshold values, compared to the level value, are configured in ascending order (level 1 threshold value > level 2 threshold value > level 3 threshold value > ...).

When the command value changes, and thus the fan level, it is only possible to switch directly into neighbouring levels (exception: start-up level). Thus, in automatic operation, it is only possible, for example, to switch from level 2 down to level 1 or up to level 3. If the command value change exceeds or undershoots the threshold values of multiple fan levels, then, starting with the current fan level, all the fan levels are activated in succession until the fan level specified by the command value is reached.

If the fan is switched off by the automatic system, then it runs on for the time configured as "Fan run-on time, heating" or "Fan run-on time, cooling", providing that these run-on times are configured in the ETS.

i In automatic mode, the fan level objects are updated according to the internal command value calculation (cyclically every 30 seconds) plus the waiting time configured for level change-over. Telegram transmission only takes place when the object values of the fan levels are changed. After a device reset, the fan level objects are updated and the status transmitted to the bus.

i If a start-up level is configured in the ETS ("Start-up via level" parameter), then, before the automatic activation of a fan level, it is possible to switch to a level, specified in the ETS and usually higher, for a brief time according to the command value (see section "Start-up level").

i The command value evaluated by the fan control in automatic mode can be optionally limited by in the top and bottom command value ranges by the parameters "Command value is 0%" to "Command value is 100% as soon as". In addition, the command value can also be increased by a constant value by the "Command value offset" parameter .

Manual operation:

With the extension input configured to "Room temperature controller control point -> Fan control auto/manual -> Activation of manual control", the controller makes a distinction as to whether it was in automatic or manual mode at the time the button was pressed.

If the controller is in automatic mode, then pressing a button switches to manual mode. The parameter "Fan level on change-over to manual" then decides whether the fan level most recently set in automatic mode is retained, the fan is switched off or a defined fan level is to be set Start-up level.

If, at the time of actuation, the manual controller is already active, then the controller switches to the next highest fan level without a delay. If the fan is in the highest level, then another actuation switches it back to the OFF level. From there, every additional press causes the fan level to be raised. The start-up level is ignored.

If the fan is switched off manually from the highest level, then it runs on for the time configured as "Fan run-on time, heating" or "Fan run-on time, cooling", providing that these run-on times are configured in the ETS. If, during the run-on time, the manual control button is pressed again, the controller will terminate the run-on time. The fan switches off briefly and then switches immediately to level 1.

i The 1-bit object "Auto/manual - toggle" only allows switching over between automatic and manual operation. It is not possible to switch the fan levels on using the object. This function is reserved solely for local control.

ℹ When changing from manual operation to automatic operation, the waiting time configured in the ETS is taken into account in the case of a connected level change.

ℹ The parameter "Fan level on switchover to manual" is not checked for plausibility in the ETS, meaning that an implausible configuration is possible. For this reason, care should be taken to ensure that there is no level in the configuration which is higher than the actual fan levels. If a level which does not exist is to be configured for the change-over to manual control, then the fan controller changes over to the maximum possible level when changing over to manual operation.

ℹ In manual operation, the start-up level only functions in certain situations (see next section "Start-up level").

11.2.8.3 Start-up level

The fan can, if it was switched off before and should now start up, be switched on at a defined start-up level. This start-up level can be any of the available fan levels, and is set in the ETS using the "Start-up via level" parameter.

ℹ The start-up level is generally one of the higher fan levels of a fan coil unit, so that at the beginning of a heating or cooling process the fan can start up correctly (reliable start-up of the fan motor through transfer of a higher torque, and thus a higher fan speed).

The start-up level remains active for the "Waiting time on level switchover" configured in the ETS. In automatic operation, the controller only switches to the fan level specified by the command value, when the waiting time has elapsed. There is no switching over if, after the waiting time has elapsed, the fan level specified by the command value matches the start-up level.

ℹ If the controlled fan requires a longer period of time for the start-up, then the waiting time in the ETS should be configured to higher values (possible time range 100 ms ... 25.5 s). It should be noted that the waiting time is also taken into account on each level change-over in automatic operation!

The start-up level is always taken into account by the fan control in automatic mode on switching the fan on (if it was previously switched off by the command value evaluation) and, in certain situations, also after activation of manual operation. On changing over to manual operation, the behaviour of the fan depends on the settings of the parameter "Fan level on changing over to manual" and "Start-up via level" and the previous fan level in automatic operation as follows:

– If, due to the "Fan level on change-over to manual" parameter, a defined level from level 1 to level 8 is requested, the controller will set this level on activating manual operation. In this case, the parameter "Start-up via level" is not taken into account if the fan was most recently switched off in automatic operation.

– If, due to the "Fan level on change-over to manual" parameter, "Fan level OFF" is requested, the controller will switch the fan off during the change-over to manual operation. On subsequent pressing of the button for manual control, the "Start-up via level" parameter is taken into account and the start-up level set. Then, the controller waits in this level until further manual operation.
– If, due to the "Fan level on change-over to manual" parameter, no defined level is requested ("No change" setting) and the fan was switched off during automatic operation, then it will remain switched off on changing over to manual operation. On subsequent pressing of the button for manual control, the fan is switched to the first level. The "Start-up via level" parameter is thus not taken into account.

i A configured start-up level is applied directly without waiting time.

i With a fan change-over via the 1-bit objects, when the fan level is changed by the controller, the active fan level is first switched off before the new level is switched on. In this case, switching off a fan level and the subsequent changeover to a new fan level is not evaluated as a fan start-up, also meaning that the start-up level is not set. In automatic operation, the start-up level is only taken into account if the fan was switched off previously by the command value evaluation (command value < level 1 threshold value minus hysteresis) and then is to start up using a new command value.

i The start-up via the start-up level also takes place after switching over from manual operation to automatic operation, providing that the fan was most recently switched off in manual operation and, in automatic operation, a new command value requires the fan to be switched on.

11.2.8.4 Fan protection

The fan protection function allows the fan of a fan coil unit, which has not been active for some time, to be temporarily switched to the maximum level. In this way, the controller fan motors can be protected against stiffness. In addition, the fan blades and the heat exchanger of the fan coil unit are protected against dust.

If the fan protection is to be used, it must be enabled using the parameter of the same name in the ETS. Fan protection can then be activated or deactivated directly using the 1-bit communication object "Ventilation - fan protection", for example using a KNX/EIB timer.

If the fan protection object has the switching value "1", then the fan protection function is active. The fan then works at the highest possible fan level and overdrives automatic and manual operation. Fan protection can then be switched off again using the "0" switching value in the communication object.

The reaction of the fan to switching fan protection depends on the operating mode of the automatic fan system.

In automatic operation, the fan switches back to the level determined by the command value of the room temperature control.

In manual operation, the fan switches off and can then be switched on again by additional manual actuation. The "Start-up via level" parameter is taken into account here.

- Even if the fan controller is inactive due to the controller operating mode, it is possible to activate the fan using fan protection.

- With an active level limit, the maximum fan level of fan protection is specified by the limit level.

- For reasons of safety, fan protection is not carried out with an active forced position.

- If fan run-on times are configured in the ETS, then the fan is switched off after a delay when fan protection is deactivated.

11.2.8.5 Fan level limit

To reduce the fan noise of a fan coil, the fan level limit can be activated. The level limit reduces the sound emissions by limiting the maximum fan level to a fan level value specified in the ETS by the "Level limit (max. fan level)" parameter (limit level). The limit can be switched on and off via the
1-bit object "Level limit - Activation/deactivation", and thus activated in accordance with requirements, for example via a timer during night-time hours in order to reduce noise in bedrooms, or via "manual" operation of a push-button sensor when a "quiet room" is needed (auditorium or the like). The limitation of the fan level is activated by receipt of a "1" telegram via the object "Level limitation - Activation/deactivation". Deactivation is therefore achieved through the receipt of a "0" telegram.

While a fan level limit is active, the fan control prevents the fan from being switched to a higher level than the limit level. If, at the instant that the limit is activated, the fan is running at a level that is greater than the limit level, then the fan level is immediately reduced to the limitation value. In this case, the switching sequence of the individual levels and the waiting time configured in the ETS are also taken into account in the level switchover.

The limitation level can be one of the available fan levels.

The level controller distinguishes between Automatic and Manual operation.

- The fan level limit overrides the start-up level. As a result, when the fan is switched on, if the limit is active, the level has an active limit and the start-up level is not approached. In this case, the limit level is jumped to without waiting.

- The fan level limit has no effect with an activated fan forced position.

11.2.8.6 Forced fan position

The controller provides the option of activating a forced fan position via the bus. With an active forced position, the fan levels can neither be controlled nor switched over in either automatic or manual mode. The fan remains in the forced state until the forced position is removed using the bus. In this manner, it is possible to switch the fan to a locked and controlled state, for example for servicing purposes.

As soon as a "1" telegram is received via the
1-bit object "Forced position - Activation/deactivation", the controller immediately sets the fan level configured in the ETS without delay. The fan can also be completely switched off. The only special feature when activating the forced position is the fact that the fan controller is in automatic operation and a waiting time elapses, due to a previous level change-over. In this case, the fan controller only switches to the forced position level without the waiting time elapsing.

i The forced position is dominant. For this reason, if connect be overdriven from automatic mode, manual mode, the level limit or fan protection. Only when the forced position is removed does the fan control begin to control the fan levels according to the active operating mode.

The removal takes place when a "0" telegram is received via the
"Forced position - Activation/deactivation" object. The fan always switches itself off first. In automatic operation, the controller then evaluates the active command value and, when the waiting time configured in the ETS has elapsed, switches to the required fan level, taking an optionally configured start-up level into account. In manual operation, the fan first remains switched off. The fan level is only raised when the manual control button is pressed again. If a start-up level is configured, the controller will, when a button is pressed, switch to the start-up level and remain there until further operation takes place.

i The parameter "Behaviour in a forced position" is not checked for plausibility, meaning that an incorrect configuration is possible. For this reason, care should be taken to ensure that there is no fan level in the configuration which is higher than the actual fan levels. If a higher level is configured for behaviour in a forced position than the number of fan levels, then the fan controller with start up the maximum possible level when the forced position is activated.

i The forced fan position does not influence the control algorithm integrated in the controller. The command values of the PI feedback control continue to be transmitted to the bus, even with a forced fan.

11.2.8.7 Command value limiting values and command value offset

In automatic operation, the command value of the controller is used internally in the device to control the fan levels, according to the fan operating mode. As a transition between the levels, there are threshold values, defined according to the command value of the controller, which can be set using parameters in the ETS. The evaluation of the controller command values can be specially influenced for automatic fan control.

The command value to be evaluated for the fan controller can be influenced by the "Command value is 0% until internal command value is greater than" parameter in the lower command value range. The fan controller only evaluates the command value according to the configured threshold values when the internal command value of the controller exceeds the configured limiting value. With smaller command values, the fan remains at a standstill.

Similarly, the command value to be evaluated for the fan controller can be limited by the "Command value is 100% as soon as internal command value is greater than" parameter in the upper command value range. In this case, the controller evaluates command values which exceed the configured limiting value as 100%. This means that the fan works at full power even with command values not at the maximum.

The "Command value offset" parameter allows configuration of a constant command value offset for the fan. The fan controller always adds the configured offset to the command value to be evaluated. The effect of this is that the fan turns at greater power than required by the command value, according to the threshold values. The result of this is that, even if the command value is switched off, the fan will continue to work when the first command value threshold value is exceeded by the offset.

i A configured command value offset cannot not affect a command value of greater than 100%. The maximum command value of the fan controller is therefore defined as 100%.

11.2.8.8 Fan control parameters

Room temperature controller .. -> RTC .. - General

Fan controller available	Active Inactive
The room temperature control can be supplemented with a fan controller. This makes it possible to control the fan from heating and cooling systems operated by circulating air, such as fan coil units, depending on the command value calculated in the controller or using manual operation. The fan controller works only in conjunction with PI feedback controls with continuous or switching (PWM) command value output. In 2-point feedback control, the fan controller is inactive, even if the function is enabled in the ETS.	

Fan operating mode (Selection depending on the operating mode of the controller)	Heating Cooling Basic heating Additional heating Basic cooling Additional cooling Heating and cooling Basic and additional heating Basic and additional cooling Basic heating and additional cooling Basic cooling and additional heating Basic heating and cooling Additional heating and cooling
Depending on the operating mode of the room temperature control, as configured in the ETS, various controller command values can be used as the basis for fan control. The "Fan operating mode" parameter specifies which command value of the controller controls the fans. With one-level room temperature control, it is possible to select whether the fan is activated during heating and/or during cooling. With two-level room temperature control, it is also possible for the fan controller to be set to the basic level or the additional level during heating and cooling.	

Room temperature controller .. -> RTC .. - General -> Fan control

Number of fan levels	1 fan level 2 fan levels 3 fan levels 4 fan levels 5 fan levels 6 fan levels 7 fan levels 8 fan levels
The fan controller of the room temperature controller supports up to 8 fan level outputs, for which the actually used number of levels (1...8) is set using this parameter.	

Fan OFF threshold value -> Level 1	0...1...100
In automatic operation, the command value of the controller is used internally in the device for automatic control of the fan levels. As a transition between the levels, there are threshold values, defined according to the command value of the controller, which can be set here. If the command value reaches the threshold value of a level during an increase of the command value, the appropriate level is activated. If the command value reaches below a threshold value, minus the configured hysteresis, during a reduction of the command value, then the switchover takes place into the next lowest fan level.	

Fan level 1 threshold value -> Level 2	0 ... 30...100

Fan level 2 threshold value -> Level 3	0 ... 60...100

Fan level 3 threshold value -> Level 4	0 ... 90...100

Fan level 4 threshold value -> Level 5	0 ... 100

Fan level 5 threshold value -> Level 6	0 ... 100

Fan level 6 threshold value -> Level 7	0 ... 100

Fan level 7 threshold value -> Level 8	0 ... 100

Hysteresis between threshold values	0...3...50
If the command value of the room temperature control has undershot the threshold value minus the hysteresis, the fan controller switches back to the previous level.	

Waiting time for level change-over	1...2...255 x 0.1 s

Due to fan motors' inertia, as a rule there is a limit to how short the time intervals for switching the fan levels can be, i.e. there is a limit to how quickly the fan speed can be varied. If the fan controller is working in automatic mode, the settable "Waiting time on level change-over" is maintained on change-over of the levels. The timer starts the waiting time as soon as a threshold value is exceeded or not reached. The device only switches the new fan level automatically when the waiting time has elapsed.

Fan level switchover via	Switching objects (8 x 1-bit) Value object (1 byte | 5.100) Value object (1 byte | 5.001)

Depending on the data format of the objects of the controlled actuators, switching over between the fan levels can either take place via up to 8 separate 1-bit objects or, alternatively, via a 1-byte object of the 5.100 or 5.001 data type. The "Fan level change-over via" parameter defines the data format of the controller. With the 1-bit objects, each fan level discreetly receives its own object. With the 1-byte object, the active fan level is expressed by a value ("0" = Fan OFF / "1" = Level 1 / "2" = Level 2 / "3" = Level 3 ...).

Specification_/_visualisation_fan level	Value object (DPT 5.100 | 0 ... 255) Value object (DPT 5.001 | 0 ... 100%)

The 1-byte object "Ventilation - fan level visualisation" can, if necessary, also be evaluated by other KNX devices (e.g. visualisation - panel / PC software). Depending on the data format of the visualisation devices, the value object DPT 5.100 or DPT 5.001 can be selected. It always transmits the current fan level as a 1-byte value, either automatically on a change or passively on reading out.

Level limit (max. fan level)	No level limit Fan level 1 Fan level 2 Fan level 3 Fan level 4 Fan level 5 Fan level 6 Fan level 7

To reduce the fan noise of a fan coil, the fan level limit can be activated. The level limit reduces the sound emissions by limiting the maximum fan level to a fan level value configured here (limitation level). The limit can be switched on and off using the "Ventilation - level limit" 1-bit object and thus activated as required.

Behaviour on forced position	No forced position Fan level 1 Fan level 2 Fan level 3 Fan level 4 Fan level 5 Fan level 6 Fan level 7 Fan level 8 Fan level OFF

The controller provides the option of activating a forced fan position via the bus. With an active forced position, the fan levels can neither be controlled nor switched over in either automatic or manual mode. The fan remains in the forced state until the forced position is removed using the bus. In this manner, it is possible to switch the fan to a locked and controlled state, for example for servicing purposes.

As soon as the forced position is activated, the controller jumps to the fan level configured in this parameter without any waiting time. The fan can also be completely switched off.

Object polarity	0 = automatic / 1 = manual 1 = automatic / 0 = manual

The parameter specifies the polarity of the object for the change-over between automatic and manual fan control. Automatic mode is always active after a device reset.

Fan level on change-over to manual	No change Fan level 1 Fan level 2 Fan level 3 Fan level 4 Fan level 5 Fan level 6 Fan level 7 Fan level 8 Fan level OFF

If the controller is switched from automatic mode to manual mode, this parameter determines whether the fan remains at the same fan level, a predefined fan level is switched on or the fan switches off.

Heating fan run-on time	0...255 x 0.1 s

If the fan is switched-off in automatic or manual operation, it runs on for the time configured at this point, provided that a factor of more than "0" is set. This parameter applies to the controller operating mode "Heating".

Cooling fan run-on time	0...255 x 0.1 s
If the fan is switched-off in automatic or manual operation, it runs on for the time configured at this point, provided that a factor of more than "0" is set. This parameter applies to the controller operating mode "Cooling".	

Fan protection	Active Inactive
The fan protection function allows the fan of a fan coil unit, which has not been active for some time, to be temporarily switched to the maximum level. In this way, the controller fan motors can be protected against stiffness. In addition, the fan blades and the heat exchanger of the fan coil unit are protected against dust against dust. If the fan protection is to be used, it must be enabled using the checkbox at this point.	

Start-up using level	Fan level 1 Fan level 2 Fan level 3 Fan level 4 Fan level 5 Fan level 6 Fan level 7 Fan level 8
The fan can, if it was switched off before and should now start up, be switched on at a defined start-up level. This start-up level can be any of the available fan levels, and is set using this parameter. The start-up level is usually one of the higher fan levels of a fan coil unit. The start-up level remains active for the "Waiting time on level switchover" configured in the ETS.	

Command value is 0%, until internal command value is greater than	0 ... 1...100 %
The command value evaluated by the fan controller in automatic operation can be optionally limited by this parameter in the bottom command value range.	

Command value is 100%, as soon as internal command value is greater than	0...99...100 %
The command value evaluated by the fan controller in Automatic mode can be optionally limited by this parameter in the top command value range.	

Command value offset	0... 100 %
The command value evaluated by the fan controller in Automatic mode can be optionally raised by the static offset configured here. Should the calculation produce a value of over 100 %, then the command value is limited to the maximum value.	

11.2.8.9 Fan control objects

Function	Name	Type	DPT	Flag
Ventilation_-_auto/ manual	RTC .. - Input	1-bit	1,001	C, - , W, T, U
1-bit object to change-over the operating mode of the fan controller (configurable polarity). When the operating mode is changed over using a button function, a telegram matching the current status is transmitted to the bus.				

Function	Name	Type	DPT	Flag
Ventilation - Auto / manual - Status	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for indicating the current status of the fan control.				

Function	Name	Type	DPT	Flag
Lüftung – Fan level - Specification	RTC .. - Input	1-byte	5,100	C, -, W, -, U
Specification of the fan level via a 1-byte object.				

Function	Name	Type	DPT	Flag
Ventilation - Fan level 1-8	RTC .. - Output	1-byte	5,100	C, R, -, T, A
1-byte object for value-guided activation of the fan levels. This object is only available in this way when fan control is to take place over 1-byte in the form 0 ... 255 (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation - Fan level 1-8	RTC .. - Output	1-byte	5,001	C, R, -, T, A
1-byte object for value-guided activation of the fan levels. This object is only available in this way when fan control is to take place over 1-byte in the form 0 ... 100% (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 1	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the first fan level. This object is only available in this way when the fan control is to take place over 8 x 1-bit and at least one fan level is enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level_2	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the second fan level. This object is only available when the fan control is to take place over 8 x 1-bit and at least two fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 3	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1-bit and three fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 4	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1 bit and four fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 5	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1 bit and five fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 6	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1 bit and six fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 7	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1 bit and seven fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan level 8	RTC .. - Output	1-bit	1,001	C, R, -, T, A
1-bit object for switching activation of the third fan level. This object is only available when fan control is to take place over 8 x 1 bit and eight fan levels are enabled (parameter-dependent).				

Function	Name	Type	DPT	Flag
Ventilation_-_Forced position	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the fan forced position. Polarity: Forced position ON = "1"; Forced position OFF = "0".				

Function	Name	Type	DPT	Flag
Ventilation - level limit	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation of the fan level limitation. Polarity: Fan level limitation ON = "1"; Fan level limitation OFF = "0".				

Function	Name	Type	DPT	Flag
Ventilation_-_Fan protection	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activating the fan protection. Polarity: Fan protection ON = "1" / Fan protection OFF = "0".				

Function	Name	Type	DPT	Flag
Ventilation_-_visualisation_fan level	RTC .. - Output	1-byte	5,100	C, R, -, T, A
1-byte object for additional value-guided acknowledgement of the active fan level. Value meaning: "0" = Fan OFF, "1" = level 1 active, "2" = level 2 active, "3" = level 3 active				

Function	Name	Type	DPT	Flag
Ventilation_-_visualisation_fan level	RTC .. - Output	1-byte	5,100	C, R, -, T, A
1-byte object for feeding back the current fan level.				

11.2.9 Disable functions of the room temperature controller

Disable controller

Certain operation conditions may require the deactivation of the room temperature control. For example, the controller can be switched-off during the dew point mode of a cooling system or during maintenance work on the heating or cooling system. The parameter "Controller output disabling object" in the parameter node "Room temperature controller .. -> RTC ..- General" enables the 1-bit object "Command value outputs - Disable" with the setting "Active". In addition, the controller disable function can be switched off when set to "Inactive".

In case a "1" telegram is received via the enabled disable object, the room temperature control will be completely deactivated. In this case, all the command values are equal to "0"/"OFF" (wait 30 s for update interval of the command values).

i The controller, however, can be operated in this case via the communication objects.

Disable additional level

The additional stage can be separately disabled when in two-stage heating or cooling mode. The parameter "Additional level disabling object" in the parameter node "Room temperature controller .. -> RTC .. - General" enables the 1-bit object "Command value outputs - Additional level - Disable" with the setting "Active". In addition, the disable function of the additional level can be switched off when set to "Inactive". In case a "1" telegram is received via the enabled disable object, the room temperature control is completely deactivated by the additional level. The command value of the additional level is "0" while the basic level continues to operate.

The controller has no function in dew point operation. The building functions to be controlled are in a critical state, which must be monitored by the building system.

A disable is always deleted after a reset (bus voltage return, ETS programming operation).

11.2.10 Valve protection function

Valve protection may be carried out periodically via an external communication object in order to prevent the addressed control valves of the heater or cooling system from becoming calcified or stuck. The parameter "Valve protection" in the parameter node "Room temperature controller .. -> RTC .. -General -> Enable" enables the parameter page valve protection via the "Active" setting.
When activated, the "Valve protection control via object" parameter enables a 1-bit communication object through which valve protection is performed via an external controller, e.g. timer or visualisation.

Thus even long closed valves will be opened briefly on a regular basis.

A controller disable has no influence on the valve protection. This means that valve protection is carried out, even when the controller is disabled.

11.2.10.1 Valve protection function parameter

Valve protection control via object	**Active** Inactive
When activated, this parameter enables a 1-bit communication object through which valve protection is performed via an external controller, e.g. timer or visualisation.	

11.2.10.2 Valve protection function objects

Function	Name	Type	DPT	Flag
Valve protection	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit object for execution of valve protection. – "0" = no valve protection – "1" = valve protection is executed				

11.2.11 Boost function

The boost function can be used temporarily to heat or cool a room intensively. If the boost function is activated via the "Boost - Activate / Deactivate" object, the command value is set to maximum (ON or 100%) in the standard parameterisation for a duration of 5 minutes. After the time has elapsed, the boost switches off again automatically.

Once the boost function has elapsed, the controller checks the current actual temperature and the setpoint temperature. The command values set to maximum by the boost function are not switched off until the corresponding temperature limits are exceeded in heating mode and undershot in cooling mode.

The parameter "Boost function" in the parameter node "Room temperature controller -> RTC .. - General -> Enable" enables the boost function parameter page. The remaining parameters can be set there.

The current status of the boost function and the residual time of a current boost can be sent to the bus.

The boost function cannot be retriggered.

The boost function can be aborted at any time.

The controller calculates the command values cyclically every 30 seconds. This can delay the adoption of the command value by a maximum of 30 s. As this delay affects switching on and off, the duration of the boost function remains unchanged.

11.2.11.1 Boost function parameters / Valve protection

Room temperature controller .. -> RTC .. - General -> Boost function

Effect on	**Heating** Cooling Heating and cooling
The boost function can optionally be used for heating only, for cooling only or for both heating and cooling. The options available for this parameter depend on the operating mode set on the parameter page "RTC .. -General" set operating mode.	

In heating mode, effect on	**Basic level heating** Additional level heating Basic and additional level heating
In the case of heating with the basic and additional levels, the boost function can optionally have an effect on the basic level only, the additional level only or both the basic and additional levels.	

In cooling mode, effect on	**Basic level cooling** Additional level cooling Basic and additional level cooling
In the case of cooling with the basic and additional levels, the boost function can optionally have an effect on the basic level only, the additional level only or both the basic and additional levels.	

Heating

Boost period	1 ... **5** ... 59 min
The device performs the boost according to the configuration of this parameter for a period of 1 to 59 minutes.	

Boost - Command value	0 ... **100 %**
For the configured duration, the command value is set to the value parameterised here, e.g. maximum (ON or 100%).	

Cooling

Boost period	1 ... **5** ... 59 min
The device performs the boost according to the configuration of this parameter for a period of 1 to 59 minutes.	

Boost - Command value	0 ... **100 %**
For the configured duration, the command value is set to the value parameterised here, e.g. maximum (ON or 100%).	

Transmission behaviour

Cyclical transmission of residual time (0 = inactive)	0...59 min 0 ... 10…59 s
If the boost function is activated, the object "Boost - Remaining run time" can cyclically transmit the residual time of the running boost function in seconds.	

Room temperature controller .. -> RTC .. - General -> Boost function

Valve protection control via object	**Active** Inactive
If "Valve protection control via object" is activated, the 1-bit communication object "Valve protection" is enabled. The valves controlled by the controller are fully opened with a "1" telegram and reset to the previous value with a "0" telegram.	

11.2.11.2 Objects Boost function / valve protection

Function	Name	Type	DPT	Flag
Boost - Activate / Deactivate	RTC .. - Input	1-bit	1,010	C, -, W, -, U
1-bit input object for requirement-orientated activation and deactivation of the boost function. The telegram polarity is fixed: "0" = boost inactive, "1" = boost active. Updates of the object from "1" to "1" or "0" to "0" do not produce a reaction.				

Function	Name	Type	DPT	Flag
Boost - Status	RTC .. - Output	1-bit	1,011	C, R, -, T, A
1-bit object via which the controller outputs the current status of the boost function. When the boost function is activated, the status object is set to the value "1". When the boost function is deactivated, the status object is set to the value "0". After a reset, the status message object value is "0". The status object is only sent when there is a change.				

Function	Name	Type	DPT	Flag
Boost - Remaining run time	RTC .. - Output	2-byte	7,005	C, R, -, T, A
2-byte object via which the controller outputs the period of the boost function. The residual time of the boost function is transmitted via the object in 10 second increments.				

Function	Name	Type	DPT	Flag
Valve protection	RTC .. - Input	1-bit	1,001	C, -, W, -, U
1-bit input object for requirement-orientated activation and deactivation of the valve protection function. The telegram polarity is fixed: "0" = valve protection inactive, "1" = valve protection active. Updates of the object from "1" to "1" or "0" to "0" do not produce a reaction.				

11.2.12 Setpoint temperature limit, cooling

In accordance with statutory requirements in Germany and elsewhere, the temperature at the workplace should be a maximum of 26 °C, or at least 6 K below outdoor temperatures higher than 32 °C. Exceeding these limits is only permissible in exception circumstances. To meet these requirements, the room temperature controller offers a setpoint temperature limit, which is only effective in cooling mode. If necessary, the controller limits the setpoint temperature to specific values and prevents an adjustment beyond the limits.

The parameter "Limitation type" in the parameter node "Room temperature controller -> RTC .. - General -> Setpoint temperature limit, cooling" can activate the limit and specify its function. The following settings are possible:

– Setting "Only difference to outdoor temperature"
  In this setting, the outdoor temperature is monitored and compare to the active setpoint temperature. The desired maximum temperature difference to the outdoor temperature can be specified in the range between 1 K and 15 K. The specification is made using the parameter "Difference between setpoint temperature and outdoor temperature of". The value can be set in step widths of 1 K.
  If the outdoor temperature rises above the value of the parameter "Limit above outdoor temperature of", then the controller activates the setpoint temperature limit. It then permanently monitors the outdoor temperature and raises the setpoint temperature so that is beneath the outdoor temperature by the amount configured. Should the outdoor temperature continue rise, the controller raises the setpoint temperature until the required difference to the outdoor temperature is achieved. It is then not possible to undershoot the raised setpoint, e.g. by changing the basic setpoint change.
  The change to the setpoint temperature limit is temporary. It only applies for as long as the outdoor temperature exceeds the value of the parameter "Limit above outdoor temperature of".
  With the setpoint temperature limit, the configured temperature difference relates to the setpoint temperature of the Comfort mode for cooling. In other operating modes, the temperature distance to Comfort mode must be taken into account.

  Example:
  In the ETS, the difference between the setpoint temperature and the outdoor temperature is set to 6 K. The standby setpoint temperature is configured to 2 K higher than the comfort setpoint temperature. The result of this is that, for command value limiting, the setpoint temperature in Standby mode may only be a maximum of 4 K below the outdoor temperature. The setpoint temperature limit applies to Night mode in the same way.

The automatic raising of the setpoint temperature by the setpoint temperature limit goes only as far as the configured heat protection temperature. Therefore the heat protection temperature can never be exceeded.

A basic setpoint shift never affects an active setpoint temperature limit with differential measurement to the outdoor temperature. In this case, the setpoint temperature limit only works with the unshifted basic setpoint. A setpoint shift active before the limitation is restored after the limitation, if it was not reset in another way, e.g. by an operating mode switchover.

If the setpoint temperature limit is active, the difference between the basic cooling and additional cooling levels is not taken into account. The command values for both levels are identical. Only when the temperature falls below the limit temperature is the difference between the levels considered again.

– Setting "only maximum setpoint temperature"
  In this setting, no setpoint temperatures that are greater than the maximum setpoint temperature configured in the ETS are permitted in cooling mode for the Comfort, Standby and Night modes. The maximum setpoint temperature is specified in the parameter "Maximum setpoint temperature in cooling mode" and can be configured within the limits 20 °C to 35 °C in steps of 1 °C.
  With an active limit, no larger setpoint can be set in cooling operation, e.g. by a basic setpoint change or a setpoint shift. However, heat protection is not influenced by the setpoint temperature limit.
  The maximum setpoint temperature configured in the ETS generally relates to the comfort setpoint temperature of cooling mode. In other operating modes, the temperature distance to Comfort mode must be taken into account. Example...
  The maximum setpoint temperature is configured to 26 °C. The standby setpoint temperature is configured to 2 K higher than the comfort setpoint temperature. The result of this is that, for command value limiting, the setpoint temperature in Standby mode is limited to 28 °C. The setpoint temperature limit applies to Night mode in the same way.
– Setting "Maximum setpoint temperature and difference to outdoor temperature"
  This setting is a combination of the two above-mentioned settings. In the downward direction, the setpoint temperature is limited by the maximum outdoor temperature difference, whilst in the upward direction, the limit is made by the maximum setpoint.
  The maximum setpoint temperature has priority over the outdoor temperature difference. This means that the controller keeps on raising the setpoint temperature according to the difference to the outdoor temperature configured in the ETS until the maximum setpoint temperature or the heat protection temperature is exceeded. Then the setpoint is limited to the maximum value.

A setpoint limit enabled in the ETS can be activated or deactivated as necessary using a 1-bit object. For this, the parameter "Activation" can be set to "via object". In this case, the controller only takes the setpoint limit into account if it has been enabled via the object "Setpoint temperature limit - Activate / Deactivate" ("1" telegram). If the limitation is not enabled ("0" telegram), the cooling setpoint temperatures are not limited. After a device reset (bus voltage return, ETS programming operation), the object value is "0", meaning that the setpoint limit is inactive.

The setpoint limit has no function in Heating mode.

Status message of the setpoint temperature limit

If a setpoint temperature limit is active, this is signalled to the bus via the object "Setpoint temperature limit - Status". This makes it possible for the user to recognise a changed temperature setpoint. After a reset, the status message object value is "0". This corresponds to the normal setpoint of the operating modes "Comfort", "Standby" and "Night". The setpoint temperature status is only sent when there is a change.

11.2.12.1 Setpoint temperature limit parameters

Limitation type	Only difference to outdoor temperature Only max. setpoint temperature **Maximum setpoint temperature and difference to outdoor temperature**

The variable on which the setpoint temperature limit depends can be defined here.

"Only difference to outdoor temperature": In this setting, the outdoor temperature is monitored and compared with the active setpoint temperature. The specification of the maximum temperature difference to the outdoor temperature is made using the "Difference to outdoor temperature in cooling mode" parameter. If the outdoor temperature rises above 32 °C, then the controller activates the setpoint temperature limit. It then permanently monitors the outdoor temperature and raises the setpoint temperature so that is beneath the outdoor temperature by the amount configured. Should the outdoor temperature continue rising, the controller raises the setpoint temperature until the required difference to the outdoor temperature is reached, or, at most, the heat protection temperature. It is then not possible to undershoot the raised setpoint, e.g. by changing the basic setpoint change. The change to the setpoint temperature limit is temporary. It only applies for as long as the outdoor temperature exceeds 32 °C.

"Only maximum setpoint temperature": In this setting, no setpoint temperatures that are greater than the maximum setpoint configured in the ETS are permitted in cooling mode for the Comfort, Standby and Night modes. The maximum temperature setpoint is specified by the "Max. setpoint temperature in cooling operation" parameter. With an active limit, no larger setpoint can be set in cooling operation, e.g. by a basic setpoint change or a setpoint shift. However, heat protection is not influenced by the setpoint temperature limit.

"Maximum setpoint temperature and difference to outdoor temperature": This setting is a combination of the two above-mentioned settings. In the downward direction, the setpoint temperature is limited by the maximum outdoor temperature difference, whilst in the upward direction, the limit is made by the maximum setpoint. The maximum setpoint temperature has priority over the outdoor temperature difference. This means that the controller keeps on raising the setpoint temperature according to the difference to the outdoor temperature configured in the ETS until the maximum setpoint temperature or the heat protection temperature is exceeded. Then the setpoint is limited to the maximum value.

Limit from an outdoor temperature of	20...**32**...45°C

This parameter defines the outdoor temperature at which limitation of the setpoint temperature becomes active in cooling mode.

Difference between setpoint temperature and outdoor temperature of	1 ...**6** ...15 K
This parameter defines the maximum difference between the setpoint temperature in Comfort mode and the outdoor temperature with an active setpoint temperature limit. This parameter is visible only if setpoint temperature monitoring is enabled. However, this is only if the parameter "Setpoint temperature limit in cooling operation" is then set to "Only difference to outdoor temperature" or "Max. setpoint temperature and difference to outdoor temperature".	

Maximum setpoint temperature	20°C...**26°C**...35°C
This parameter defines the maximum setpoint temperature in Comfort mode with an active setpoint temperature limit. This parameter is visible only if setpoint temperature monitoring is enabled. However, this is only if the parameter "Setpoint temperature limit in cooling operation" is then set to "Only max. setpoint temperature" or "Max. setpoint temperature and difference to outdoor temperature".	

Activation	**Via object** Permanently active
A setpoint limit enabled in the ETS can be activated or deactivated as necessary using a 1-bit object. For this, this parameter can be set to "Via object". In this case, the controller only takes the setpoint limit into account, if it has been enabled via the object "Cooling setpoint temperature limit" ("1" telegram). If the limitation is not enabled ("0" telegram), the cooling setpoint temperatures are not limited. This parameter is visible only if setpoint temperature monitoring is enabled.	

11.2.12.2 Objects for setpoint temperature limit

Function	Name	Type	DPT	Flag
Setpoint temperature limit - Activate / Deactivate	RTC Input	1-bit	1,001	C, -, W, -, U
1-bit object for activation or deactivation of a setpoint temperature limit. – "0" = deactivate raising of setpoint – "1" = activate raising of setpoint If the setpoint limit is permanently activated, the communication object is not visible.				

Function	Name	Type	DPT	Flag
Setpoint temperature limit - Status	RTC - Output	1-bit	1,011	C, R, -, T, A
1-bit object for signalling an active setpoint temperature limit. – "0" = raising of setpoint not active – "1" = raising of setpoint active				

11.2.13 Setpoint temperature increase, heating

The room temperature controller offers a setpoint temperature increase, which is only effective in heating mode.

The comfort and standby setpoints are raised gradually as the outdoor temperature falls. This counteracts the radiative cooling from outdoor walls in winter, increasing the sense of well-being. The working range can be configured and is defined via the parameter "Raise from difference between setpoint temperature and outdoor temperature of".

The following values are used for calculation of the setpoint temperature increase:

– Setpoint temperature (before increase)
– Current outdoor temperature
– Configured difference between setpoint temperature and outdoor temperature
– Increase factor

These values are used in the following formula:

Setpoint temperature increase = Setpoint temperature + (Setpoint temperature - (Outdoor temperature +
Difference between setpoint temperature and outdoor temperature)) x Increase factor

Example for setpoint temperature increase: - Heating Comfort mode setpoint temperature = Specified setpoint temperature = 21 °C - Difference between setpoint temperature and outdoor temperature = 10 K - Increase factor = 10
Outdoor temperature = 11 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.0 °C -> Set setpoint temperature = Specified setpoint temperature = 21 °C
Outdoor temperature = 10 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.1 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.1 °C
Outdoor temperature = 9 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.2 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.2 °C
Outdoor temperature = 8 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.3 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.3 °C

If the value of the shifted outdoor temperature (grey characteristic line) falls below the value of the specified setpoint temperature (green characteristic line), the calculated setpoint temperature (blue characteristic line) becomes active. When setpoint temperature increase is activated, the calculated setpoint is then set as the setpoint temperature. Correspondingly, the specified setpoint temperature is reactivated when the calculated setpoint temperature value falls below the specified setpoint temperature.

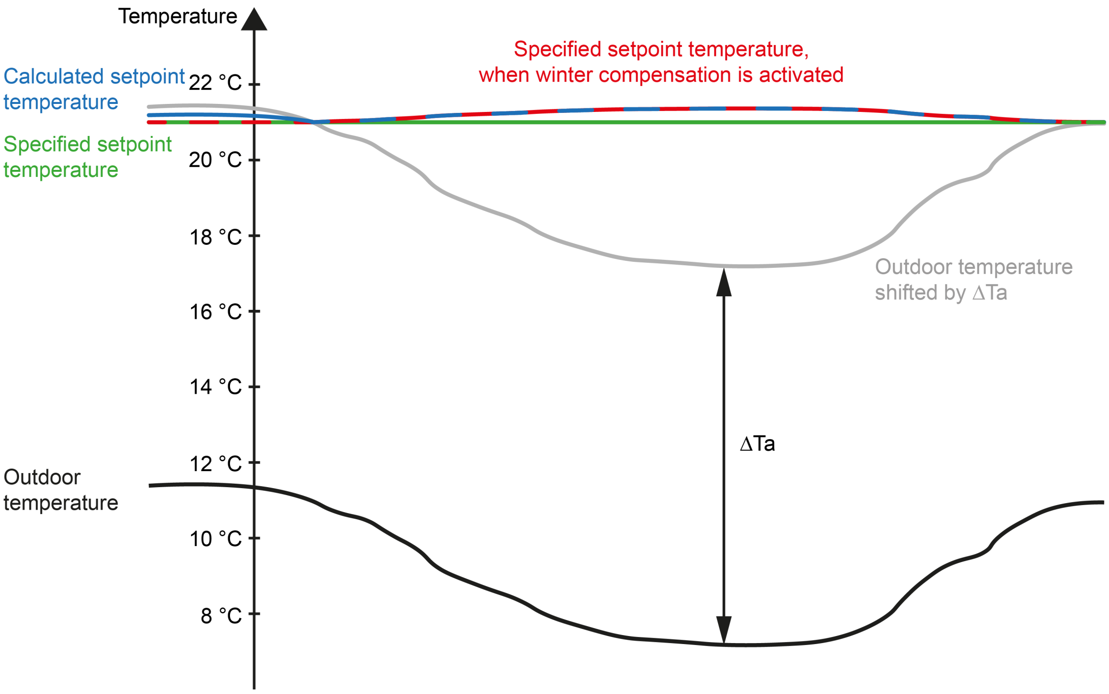

Figure 74: Example for winter compensation

ΔTa Configured difference between setpoint temperature and outdoor temperature

Additional information about setpoint temperature increase, heating

– The precondition for "setpoint temperature increase, heating" is reception of a valid outdoor temperature.
– Setpoints shifted by "setpoint temperature increase, heating" are checked against the frost and heat protection temperatures and if they fall below or exceed them respectively, they are restricted to these values.
– The "setpoint temperature increase, heating" only works in the operating modes Comfort and Standby.
– Switching between heating and cooling changes the operating mode; which is the corresponding precondition for "setpoint temperature increase, heating".
– "Cooling" mode switches "setpoint temperature increase, heating" to inactive and sets its offset to the value "0".
– An operating mode switchover to Comfort or Standby operating mode does not affect the "setpoint temperature increase, heating". By contrast, the Night and Frost/heat protection modes switch the "setpoint temperature increase, heating" to inactive.

Status message of setpoint temperature increase, heating

If "setpoint temperature increase, heating" is active, this is signalled to the bus via the object "Setpoint temperature increase - Status". This makes it possible for the user to recognise a changed temperature setpoint. After a reset, the status message object value is "0". This corresponds to the normal setpoint of the operating modes "Comfort", "Standby" and "Night". The setpoint temperature status is only sent when there is a change.

11.2.13.1 Setpoint temperature increase parameters

Increase beyond difference between setpoint temperature and outdoor temperature of	10 ...**15** ...20 K
This parameter defines the difference between the setpoint temperature and the outdoor temperature beyond which the setpoint temperature increase gradually takes effect.	

Increase factor	**0**...0.2
This parameter defines the intensity of the setpoint temperature increase.	

11.2.13.2 Objects for setpoint temperature increase

Object no.	Function	Name	Type	DPT	Flag
1316	Setpoint temperature increase - Status	RTC - Output	1-bit	1,011	C, R, -, T, A
1-bit object for signalling an active setpoint temperature increase. – "0" = raising of setpoint not active – "1" = raising of setpoint active					

11.2.14 Floor temperature monitoring

The cyclical monitoring of the floor temperature can be activated in the controller in order to influence the minimum or maximum temperature of a floor heating system. If the monitoring is enabled in the ETS, the controller continuously monitors the floor temperature. If the floor temperature exceeds a specified limiting value during heating or falls below a specified limiting value during cooling, the controller switches off the corresponding command value for heating or cooling. This switches off the heating or cooling and the system cools down or heats up. The controller will only set the most recently calculated command value again when the temperature exceeds / falls below the limiting value minus a hysteresis of 1 K.

i With a pulse width-modulated command value, the temperature limit only switches off the command value when the current PWM time cycle has elapsed.

i Depending on the configuration, the temperature may have a strong impact on the controller behaviour. Poor parameterisation of the limit temperature (limit temperature near to the room/setpoint temperature) means that it is possible that the specified setpoint temperature for the room can never be reached!

i The cyclical monitoring of the floor temperature is used to increase the comfort behaviour of the heating/cooling system and must not be used as a safety-relevant protection function (immediate forced switch-off of the heating/cooling performance).

Which operating mode the cyclical monitoring should be applied to can be set in the ETS. It is possible to limit the minimum and / or the maximum floor temperature by the parameter "Monitoring of". In two-level heating or cooling mode, it is also possible to set whether the floor temperature limit applies to the basic level only, the additional level only or both the basic and additional levels.

The underfloor heating temperature to be monitored is fed into the controller via the KNX communication object "Floor temperature - Measured value". This object can be used to inform the controller of the current floor temperature using suitable temperature value telegrams from other bus devices (e.g. analogue input with temperature sensor, etc.).

The minimum and maximum limit temperatures the underfloor heating system is permitted to reach are specified in the ETS via the parameters "Maximum permissible floor temperature" and "Minimum permissible floor temperature". The temperatures can be set to a value between 10 ... 45 °C. If the limit temperature is exceeded in heating mode or fallen below in cooling mode, the controller switches the floor heating system off via the command value. As soon as the floor temperature has fallen 1 K below the limit temperature in heating mode or risen 1 K above the limit temperature in cooling mode, the controller switches the command value on again, assuming this is provided for in the control algorithm. The hysteresis 1 K is fixed.

The cyclical monitoring does not affect the "Heating" or "Cooling" message telegrams. If the floor temperature exceeds or falls below the limiting value, only the command value is switched off. In this case, the "Heating" or "Cooling" message remains active.

Depending on the configuration, the temperature limiting can have a strong impact on the controller behaviour. Poor parameterisation of the limit temperature (limit temperature near to the room/setpoint temperature) means that it is possible that the specified setpoint temperature for the room can never be reached.

The limiting temperatures for minimum and maximum are not checked for plausibility. The following generally applies: "Minimum permissible floor temperature" < allowed floor temperature range < "Maximum permissible floor temperature".

11.2.14.1 Floor temperature monitoring parameters

Monitoring of	**Maximum floor temperature** Minimum floor temperature Maximum and minimum floor temperature
This parameter determines which operating mode the cyclical floor temperature monitoring should be applied to. The monitoring can be limited to heating (maximum floor temperature), cooling (minimum floor temperature), or heating and cooling.	

Effect on	Basic level Additional level **Basic and additional level**
Depending on which heating or cooling circuit is used for the floor, this parameter defines which level is affected by the floor temperature monitoring.	

Heating

Maximum permissible floor temperature	10 ... **35** ... 45 °C
The maximum limit temperature which the floor may reach in heating mode is specified here. If this temperature is exceeded, the controller switches the underfloor heating system off using the command value. As soon as the floor temperature has fallen 1 K under the limit temperature, the controller switches the command value on again, assuming that this is provided for in the control algorithm.	

Cooling

Minimum permissible floor temperature	**10** ... 45 °C
The minimum limit temperature which the floor may reach in cooling mode is specified here. If the temperature falls below this value, the controller switches the underfloor cooling system off using the command value. As soon as the floor temperature has risen 1 K above the limit temperature, the controller switches the command value on again, assuming that this is provided for in the control algorithm.	

11.2.14.2 Objects for floor temperature monitoring

Function	Name	Type	DPT	Flag
Floor temperature - Limiting value exceeded/undershot - Status	RTC - Output	1-bit	1,011	C, R, -, T, A
1-bit object for the status output of the monitoring of the configured limiting values of the floor temperature. If the monitoring is enabled in the ETS, the controller continuously monitors the floor temperature. If the floor temperature exceeds a specified limiting value during heating or falls below a specified limiting value during cooling, the controller switches off the corresponding command value for heating or cooling. This switches off the heating or cooling. The controller will only set the most recently calculated command value again when the temperature exceeds / falls below the limiting value minus a hysteresis of 1 K again.				

Function	Name	Type	DPT	Flag
Floor temperature - Measured value	RTC Input	2-byte	9,001	C, -, W, -, U
2-byte object for coupling an external temperature sensor for floor temperature monitoring. The temperature value must always be specified in the format "°C".				

11.2.15 Parameter group "Room temperature controller"

General

Room temperature controller function 1	Disabled **Enabled** Controller extension
The controller function block integrated in the device can either work as a main controller or, alternatively, as a controller extension. The setting of this parameter has a major impact on the function and on the other parameters and objects displayed in the ETS. Switched-off: The Controller 1 function block is switched off completely. No room temperature control and controller extension function can be executed by the device. Switched-on: The Controller 1 function block works as a main controller. The internal control algorithm is active, meaning that Controller 1 of the device can be used for single-room temperature control. Controller extension: The Controller 1 function block works as a controller extension. A controller extension itself is not involved in the temperature regulating process. With it, the user can operate the single-room controller, i.e. the main controller from different places in the room. Any number of controller extensions can be controlled by a main controller. In the function as a controller extension, settings relating to the integrated controller are not possible in the menu level.	

Room temperature controller function 2	**Disabled** Enabled Controller extension
The controller function block integrated in the second device can either work as a main controller or, alternatively, as a controller extension. The setting of this parameter has a major impact on the function and on the other parameters and objects displayed in the ETS. Switched-off: The Controller 2 function block is switched off completely. No room temperature control and controller extension function can be executed by the device. Switched-on: The Controller 2 function block works as a main controller. The internal control algorithm is active, meaning that Controller 2 of the device can be used for single-room temperature control. Controller extension: The Controller 2 function block works as a controller extension. A controller extension itself is not involved in the temperature regulating process. With it, the user can operate the single-room controller, i.e. the main controller from different places in the room. Any number of controller extensions can be controlled by a main controller. In the function as a controller extension, settings relating to the integrated controller are not possible in the menu level.	

11.2.15.1 Room temperature controller

Room temperature controller .. -> RTC .. - General

Operating mode	**Heating** Cooling Heating and cooling Basic and additional heating Basic and additional cooling Basic and additional heating and cooling

The room temperature controller distinguishes between two different operating modes. The operating modes specify whether you want the controller to use its command value to trigger heating systems ("heating" single operating mode) or cooling systems ("cooling" single operating mode). You can also activate mixed operation, with the controller being capable of changing over between "Heating" and "Cooling" either automatically or, alternatively, controlled by a communication object.
In addition, you can establish two-level control operation to control an additional heating or cooling unit. For two-level feedback control, separate command values will be calculated as a function of the temperature deviation between the setpoint and the actual value and transmitted to the bus for the basic and additional levels.
This parameter specifies the operating mode and, if necessary, enables the additional level(s).

Fan controller available	Active **Inactive**

The room temperature control can be supplemented with a fan controller using this parameter. By enabling the fan controller ("Yes" setting), it is possible to control the fan from heating and cooling systems operated by circulating air, such as fan coil units (FanCoil units), depending on the command value calculated in the controller or using manual operation.
When the function is enabled additional parameters will appear in the ETS in the "Room temperature control -> Controller general -> Fan controller" as well as additional communication objects. Fan control is not possible with switching 2-point feedback control.

Fan operating mode	Heating Cooling Heating and cooling Basic heating Additional heating Basic cooling Additional cooling Basic heating and cooling Basic heating and additional cooling Basic cooling and additional heating Additional heating and cooling
Depending on the operating mode of the room temperature control, as configured in the ETS, various controller command values can be used as the basis for fan control. The "Fan operating mode" parameter specifies which command value of the controller controls the fan controller. With one-level room temperature control, it is possible to select whether the fan is activated during heating and/or during cooling. With two-level room temperature control, it is also possible for the fan controller to be set to the basic level or the additional level during heating and cooling. However, under no circumstances is it possible to use the basic and additional levels simultaneously for a fan controller within an operating mode. This basic setting of this parameter depends on the selected controller operating mode.	

Command values for heating and cooling	**To separate objects (4-pipe / 2 circuits)** to a shared object (2-pipe / 1 circuit)
This function is used, if the same heating system is used to cool the room in the summer and used to heat the room in the winter. This parameter is only visible with "heating and cooling" mixed operating mode, if applicable, with additional levels.	

Additional separate command value objects	Active **Inactive**
When this parameter is activated, further command value objects appear for the individual operating modes.	

Type of control (if applicable, for basic and additional level)	**Continuous PI control** Switching PI control (PWM) Switching 2-point feedback control (ON/OFF)
Selecting a feedback control algorithm (PI or 2-point) with data format (1-byte or 1-bit) for the heating system	

Type of heating (if applicable, for basic and additional level)	Hot water heater (1.0 K / 830 min) **Underfloor heating (1.5 K / 1000 min)** Electric heating (1.0 K / 830 min) Fan coil unit (1.0 K / 500 min) Split unit (1.0 K / 500 min) via control parameter
Adapting the PI algorithm to different heating systems using predefined values for the proportional range and reset time control parameters. With the "Using control parameters" setting, it is possible to set the control parameters in a manner deviating from the predefined values within specific limits. This parameter is only visible if "Type of heating control = Continuous PI control".	

Proportional range	**1** ... 127 K
Separate setting of the "Proportional range" control parameter. This parameter is only visible if "Type of heating = via control parameter" and the heating control type "PI control".	

Reset time (0 = inactive)	0...**830**...2550 min
Separate setting of the "Reset time" control parameter. This parameter is only visible if "Type of heating = via control parameter" and the heating control type "PI control".	

Lower hysteresis limit	-12.8...**-0.5** K
Definition of bottom hysteresis (switch-on temperatures) of the heating. This parameter is only visible if "Type of control = Switching 2-point control".	

Upper hysteresis limit	**0.5**...12.7 K
Definition of top hysteresis (switch-off temperatures) of the heating. This parameter is only visible if "Type of control = Switching 2-point control".	

Type of control	**Continuous PI control** Switching PI control (PWM) Switching 2-point feedback control
Selecting a feedback control algorithm (PI or 2-point) with data format (1-byte or 1-bit) for the cooling system	

Type of cooling (if applicable, for basic and additional level)	**Cooling ceiling (1.0 K / 830 min)** Fan coil unit (1.0 K / 500 min) Split unit (1.0 K / 500 min) Floor cooling (1.5 K / 1000 min) via control parameter
Adapting the PI algorithm to different cooling systems using predefined values for the proportional range and reset time control parameters. With the "Using control parameters" setting, it is possible to set the control parameters in a manner deviating from the predefined values within specific limits. This parameter is only visible if "Type of cooling control = PI control".	

Lower hysteresis limit	-12.8...**-5** K
Definition of bottom hysteresis (switch-off temperatures) of the cooling. This parameter is only visible if "Type of cooling control = Switching 2-point feedback control (ON/OFF)".	

Upper hysteresis limit	**0.5**...12.7 K
Definition of top hysteresis (switch-on temperatures) of the cooling. This parameter is only visible if "Type of cooling control = Switching 2-point feedback control (ON/OFF)".	

Heating/cooling switchover	Automatic via RTC **Via object**
Automatic via RTC: In this case, a heating or cooling mode will be automatically activated, depending on the room temperature determined and on the given temperature basic setpoint, or on the deadband, respectively. If the room temperature is within the preset deadband neither heating nor cooling will take place (both command values = "0"). If the room temperature is higher than the cooling temperature setpoint cooling will take place. If the room temperature is lower than the cooling temperature setpoint heating will take place. Via object: In this case, the operating mode is controlled via the "Heating/cooling operating mode" object, regardless of the deadband.	

Additional level disabling object	Active **Inactive**
The additional stages can be separately disabled via the bus. The parameter enables the disable object as necessary. This parameter is only visible in two-level heating and cooling operation.	

Object polarity	**0 = enabled / 1 = disable** 1 = enabled / 0 = disable
The parameter determines the polarity of the disabling object of the additional level. The additional level is enabled after a device reset.	

Controller output disabling object	Active **Inactive**
Certain operation conditions may require the deactivation of the room temperature control. For example, the controller can be switched-off during the dew point mode of a cooling system or during maintenance work on the heating or cooling system. The parameter "Controller output disabling object". In case a "1" telegram is received via the enabled disable object, the room temperature control will be completely de-activated. In this case, all command variables are equal to "0"/"OFF"	

Object polarity	**0 = controller switched on / 1 = controller switched off** 1 = controller switched on / 1 = controller switched off
The parameter determines the polarity of the disabling object of the controller. The controller is switched on after a device reset.	

Operating mode after reset	**Heating** Cooling Operating mode before reset
This parameter specifies which operating mode is set immediately after a device re-set. This parameter is only displayed if an operating mode is selected that includes both heating and cooling.	

Operation mode after reset	Restore operating mode before reset **Comfort** Standby Night Frost/heat protection
This parameter specifies which operating mode is set immediately after a device re-set. With "Restore operation mode before reset": The mode set before a reset according to the operating mode object will be restored after the initialising phase of the device. Operating modes set by a function with a higher priority before the reset (Forced, Window status, Presence status) are not effected.	

11.2.16 Objects "Room temperature controllers"

Objects for Controller 1 and Controller 2. Both controllers possess the same communication objects.

Function	Name	Type	DPT	Flag
Setpoint temperature - Basic value	RTC .. - Input	2-byte	9,001	C, -, W, -, U
2-byte object for external specification of the basic setpoint for relative setpoint specification. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received via the object depending on the configured interval of the basic setpoint shift (0.1 K or 0.5 K). The temperature value must always be specified in the format "°C".				

Function	Name	Type	DPT	Flag
Setpoint temperature - Active operating mode	RTC .. - Input	2-byte	9,001	C, -, W, -, U
2-byte object for external setting of a setpoint for absolute setpoint presetting. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received via the object to 0.1 K. The temperature value must always be specified in the format "°C". The setpoint modified by the setpoint shift can be reported back to the bus via the object by setting the "Transmit" flag.				

Objects for operating mode change-over

Function	Name	Type	DPT	Flag
Operating mode - Preset	RTC .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for change-over of the operating mode of the controller according to the KNX specification.				

Function	Name	Type	DPT	Flag
Operating mode - Forced	RTC .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for forced change-over (highest priority) of the operating mode of the controller according to the KNX specification.				

Function	Name	Type	DPT	Flag
Frost/heat protection - Window contact	RTC .. - Input	1-bit	1,019	C, -, W, -, U
1-bit object for the coupling of window contacts. Polarity: Window open = "1", window closed = "0".				

Object for operating mode change-over

Function	Name	Type	DPT	Flag
Operating mode - Heating/cooling	RTC .. - Output	1-bit	1,100	C, -, W, -, U
1-bit object to transmit the automatically set operating mode of the controller ("Heating" or "Cooling" modes). Object value "1" = Heating; Object value "0" = Cooling. This object is only available in this way when the operating mode change-over is to take place automatically (parameter-dependent).				

Objects for controller disabling functions

Function	Name	Type	DPT	Flag
Command value outputs - Disabling	RTC .. - Input	1-bit	1,003	C, -, W, -, U
1-bit object for deactivating the controller (activating dew point operation). Polarity: Controller deactivated = "1", controller activated = "0".				

Function	Name	Type	DPT	Flag
Command value outputs - Additional value - Disabling	RTC .. - Input	1-bit	1,003	C, -, W, -, U
1-bit object for deactivating the additional level of the controller. Polarity: Additional level deactivated = "1", additional level activated = "0". This object is only available in this way if two-level heating or cooling operation is configured.				

11.2.17 Scenes

Up to 16 scenes can be created for the room temperature controller and scene values (operating mode) stored. The scene values are recalled or stored via a separate scene extension object. The data point type of the extension object permits addressing of all scenes.

The scene function must be enabled on the parameter page "Room temperature controller .. -> RTC .. - General ->Enabled functions" for the switching output, in order for the required communication objects and parameters (on the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes") to become visible.

The scene configuration selected in the parameterization decides whether the number of scenes is either variable (1 ... 16) or alternatively fixed to the maximum (16).

- Scene configuration = "variable (1 ... 16 scenes)"
  With this setting, the number of scenes used can be selected anywhere in the range 1 to 16. The parameter "Number of scenes" decides how many scenes are visible in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 16) controls each scene.
- Scene configuration = "fixed (16 scenes)"
  With this setting, all scenes are always visible and can therefore be used. The scenes are controlled via permanently assigned scene numbers (1 ... 16) (scene number 1 -> scene 1, scene number 2 -> scene 2 ...). If necessary, individual scenes can be deactivated.

The scene function can be combined together with other functions of the room temperature controller, whereby the last received or set state is always executed.

Presetting a scene recall delay

Each scene recall of the room temperature controller can also be optionally delayed. With this feature, dynamic scene sequences can be configured if several scene outputs are combined with cyclical scene telegrams.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller .. -> RTC .. - General -> Enabled functions".

- On the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes" activate the parameter "Delay scene recall".

  The delay time is now activated and can be configured separately. The delay only affects the scene recall of the room temperature controller. The delay time is started on arrival of a recall telegram. Only after the time has elapsed is the corresponding scene called up and the operating mode set.

Each scene recall telegram restarts the delay time and retriggers it. If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old (and not yet recalled scene) will be rejected and only the scene last received executed.

The scene recall delay has no influence on the storage of scene values. A scene storage telegram within a scene recall delay terminates the delay and thus the scene recall.

Presetting the behaviour during ETS programming

When saving a scene, the operating modes are stored internally in the device in a non-volatile manner. To ensure that the stored values are not replaced by the originally programmed scene operating modes during an ETS programming operation of the application program or the parameters, the actuator can prevent the operating modes from being overwritten. As an alternative, the original values can be reloaded into the device during each programming run of the ETS.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller .. -> RTC .. - General -> Enabled functions".

- On the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes", activate the parameter "Overwrite values stored in the device during the ETS programming operation".

  With each ETS programming operation of the application program or the parameters, the scene operating modes configured in the ETS are programmed into the actuator. This may overwrite the scene operating modes stored in the device by means of a storage function.

- Deactivate the parameter "Overwrite values stored in the device during the ETS programming operation".

  Scene operating modes that may have been stored in the device by means of a storage function are maintained. If no scene switching states have been stored, the last operating modes programmed in by the ETS remain valid.

When commissioning the actuator for the first time, the parameter should be activated so that the operating mode is initialised to valid scene operating modes.

Presetting scene numbers and scene operating modes

The presetting of the scene number can be defined for each scene of the room temperature controller, by which scene number (1 ... 16) the scene is addressed, i.e. recalled or saved.
The data point type of the scene extension object permits addressing of up to 16 scenes max.

In addition to defining the scene number, it must be defined which scene command (Comfort mode, Standby mode, Night mode, Frost/heat protection) is to be set when a scene is called up on the room temperature controller.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller .. -> RTC .. - General -> Enabled functions".

- On the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes", set the parameter for each scene to the numbers with which the scenes are to be addressed.

  A scene can be addressed with the configured scene number. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible.

If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.

- On the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes", set the "Operating mode" parameter for each scene to the desired operating mode.

  With a scene recall, the configured operating mode is recalled and set at the room temperature controller.

The configured operating mode is adopted in the actuator during an ETS programming operation only if the parameter "Overwrite values stored in the device during the ETS programming operation" is activated.

Presetting storage behaviour

The operating mode set on the room temperature controller can be stored internally when a scene storage telegram is received via the extension object. The operating mode can be influenced by all functions of the room temperature controller before storage, provided that the individual functions are also enabled.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller .. -> RTC .. - General -> Enabled functions".

- On the parameter page "Room temperature controller .. -> RTC .. - General -> Scenes" activate the parameter "storage function" for the desired scenes.

  The storage function is activated for the scenes in question. When a storage telegram is received via the "Scene extension" object, the current operating mode is stored internally.

- Deactivate the parameter "storage function" for the desired scenes.

  The memory function is deactivated for the affected scenes. A storage telegram received via the "scene extension" object will be rejected.

11.2.17.1 Scene parameters

Room temperature controller .. -> RTC .. - General -> Enabled functions

Scenes	Active **Inactive**
This parameter can be used disable or to enable the scene function.	

Room temperature controller .. -> RTC .. - General: -> Scenes

Delay scene recall	Active **Inactive**
A scene is recalled via the scene extension object. If required, the scene recall can be delayed on reception of a recall telegram (parameter activated). The recall is alternatively made immediately on reception of the telegram (parameter deactivated).	

Delay time	**0**...59 min 0 ... **10**…59 s
This parameter specifies the length of the scene delay time.	

Overwrite values stored in the device during the ETS programming operation	**Active** Inactive
During storage of a scene, the scene values are stored internally to memory in the device. To prevent the stored values from being replaced during ETS programming by the originally programmed scene values, the actuator can inhibit overwriting of the scene values (parameter deactivated). As an alternative, the original values can be reloaded into the device during each programming run of the ETS (parameter activated).	

Scene configuration	**Variable (1...16 scenes)** Fixed (16 scenes)
The scene configuration selected here decides whether the number of scenes is either variable (1 ... 16) or alternatively fixed to the maximum (16). Variable (1...16 scenes): With this setting, the number of scenes used can be selected anywhere in the range 1 to 16. The parameter "Number of scenes" decides how many scenes are visible for the switching output in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 16) controls each scene. Fixed (16 scenes): With this setting, all scenes are always visible and can therefore be used. The scenes are controlled via permanently assigned scene numbers (1 ... 16) (scene number 1 -> scene 1, scene number 2 -> scene 2 ...). If necessary, individual scenes can be deactivated.	

Number of scenes	1...**10**...16
This parameter defines how many scenes are visible for the room temperature controller in the ETS and can therefore be used.	

Scene number	0...1*...16 *: The predefined scene number is dependent on the scene (1...16).
It is possible to preset which scene number (1 ... 16) controls each scene. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible. If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.	

Operating mode	Comfort Standby Night mode Frost/heat protection
This parameter is used for configuring the´operating mode which is set when the scene is recalled.	

Memory function	Active Inactive
If the parameter is activated, the storage function of the scene is enabled. The current operating mode can then be stored internally via the extension object on receipt of a storage telegram. If the parameter is deactivated, the storage telegrams are rejected.	

11.2.17.2 Objects for scenes

Function	Name	Type	DPT	Flag
Scenes - Extension	RTC Input	1-byte	18,001	C, -, W, -, U
1-byte object for polling or saving a scene.				

11.3 Controller extension

The device unites two independent room temperature controllers (Controller 1 and Controller 2). Each controller is an independent function section of the device and has its own parameter and object range in the ETS. Therefore, the room temperature controllers can be switched on or off, irrespective of the pushbutton sensor function, or configured as a controller extension.

A controller can be used for single-room temperature control. Depending on the operating mode, current temperature setpoint and room temperature, command values for heating or cooling control and fan controller can be sent to the KNX. These command values are usually then converted by a suitable KNX actuator, e.g. heating or switching actuators or directly by bus-compatible actuating drives, evaluated and converted to physical variables for air conditioning control.

The controllers of the device can either work as a main controller or as a controller extension. As the main controller, the room temperature controller function is fully switched on and the control algorithm activated. Only the main controller transmits control value telegrams. A controller extension itself is not involved in the temperature regulating process. It allows the user to view controller information on the display from various points in the room.

In this chapter, the functions of the room temperature controller are described as an extension.

ℹ The following chapters on controller extension apply for both Controller 1 and Controller 2. The functions of both controllers are identical.

11.3.1 Connection to room temperature controller

Function

The buttons and rockers of the TSM and TSEM can be used to control a KNX room temperature controller. To do this, they must be set to the "Room temperature control point" function.
If the display is also to adopt the display function of the controlled controller, one of the two internal controllers on the "General" parameter page must be configured to "Controller extension".

The controller extension itself is not involved in the regulating process. With it, the user can operate the single-room regulation from different places in the room and have the temperature values and operating modes shown on the display.

Typical KNX room temperature controllers generally offer different ways of influencing or visualising the room temperature control...

– Switching over between different modes of operation (e.g. "Comfort", "Night" ...) with different setpoint temperatures assigned to each mode by the controller.
– Signalling the presence of a person in a room. The signalling may also be combined with a configured switchover in the mode of operation.
– Readjustment of the setpoint temperature in levels which are referred in each case to the configured setpoint temperature of the current operating mode (basic setpoint shift).

The TSM and TSEM can, even independently of the controller extension function, indicate the state of one or more room temperature controllers with the status LED. This feature permits the indication of operating modes or the bit-oriented evaluation of different status objects of controllers. With the controller extension function "Setpoint temperature - shift" and "Ventilation - fan level visualisation", the status LEDs can also signal the status of the corresponding functions directly.

All communication objects of the "Controller extension - Input" update automatically after a reset or after an ETS programming operation if the "Value request of controller extension" parameter on the "Controller extension" parameter page is set to "Active". Updating is effected by means of a ValueRead telegram to the room temperature controller. This must answer the request with a ValueResponse telegram. If the device does not receive all or some of the answers, the affected objects are initialised with "0". In this case, the objects must first be actively rewritten by the bus after a reset. This is also the case, when the "Value request from controller extension?" is set to "Inactive".

As on the main controller, various items of status information of the temperature controller can be shown on the device display. As the displayed states, and information and also some operating functions are strongly dependent on the parameterisation of the main controller, the controller extension must also be configured and thus match the functions of the main controller.

In addition to the status indication on the device display, the device can indicate the state of one or more room temperature controllers with the status LEDs of the rockers or buttons. This feature permits the indication of operating modes or the bit-oriented evaluation of different status objects of controllers. With the controller extension function "Setpoint temperature shift" and "Temporary fan level display", the status LEDs can also signal the status of the shift directly.

Communication objects

The controller extension can work properly only if all extension objects are linked with the objects of the same function in the main controller. Each controller extension with the objects exists only once in the device (indication in the object name "Controller extension n"). All functions configured for the controller extension act on the corresponding objects.
Objects with the same function can be linked together using identical group addresses, meaning that multiple controller extensions can display the status information of one main controller.

The actual temperature of the room can be determined via the "Temperature sensor - Actual temperature - Status" communication object and shown in the display via the "Room temperature - Actual value" communication object of the controller extension.

11.3.2 Operating functions

Operating mode switchover

Switchover of the controller operating mode can be effected in accordance with the standard function block for room temperature controllers defined in the KNX handbook using two 1-byte communication objects. The operating mode can be switched over with the normal and with the forced objects. The "Operating mode - Preset" object offers a selection between the following operating modes:

– Comfort
– Standby
– Night
– Frost/heat protection

The "Operating mode - Forcing" communication object has the higher priority. It permits forced switching between the following modes of operation:

– Auto (normal operating mode switchover)
– Comfort mode
– Standby mode
– Night mode
– Frost/heat protection mode

The operating mode transmitted to the bus when pressing the button of the room temperature control point is defined by the parameter "When pressed". Depending on the configured functionality, it is possible that

– either one of the above-mentioned modes is activated (direct selection) on pressing the button,
– or the device is switched over between two or three modes (switching).

Notes on switching:
In order to ensure that a change-over from one operating mode to another works properly even from different locations, the operating mode objects of the controller and those of all controller extensions must be interlinked and have their "Write" flag set. In the objects concerned, this flag is set by default.
By checking the linked operating mode status object, the controller extension knows which of the possible operating modes is active. Based on this information, the device switches over into the next operating mode in sequence when a button is actuated. In the event that none of the possible operating modes is active, the next operating mode in the sequence is set to '"Comfort" mode (in case of "Standby - >Night" to "Standby" mode). As far as switching over between the forced operating modes and "Auto" is concerned, the device switches into the "Auto" operating mode when none of the configured operating modes is active.

It is not possible to program a reaction on release of the button. A long button-press is evaluated in the same way as short one and switches into the corresponding operating mode insofar as this is acceptable for the controller.

If a status LED is to indicate the current operating mode, the status LED function must be programmed for "Operating mode indication" and its status object be linked with the corresponding group address for operating mode change-over with normal or high priority.

Setpoint temperature shift

Another function of the room temperature control point that is available is the target temperature shift. It uses either a 2-byte communication object with the data point type 9.002 for relative shift or the data point type 9.001 for absolute shift of the setpoint temperature. The 1-byte communication object with data point type 6.010 can also be selected for a shift via counted pulses. Pressing a button thus allows the shift of a setpoint on a room thermostat.
A button parameterised as a setpoint temperature shift reduces or increases the value of the setpoint temperature by the specified increment one time each time the button is pressed. The direction of the value adjustment is defined by the parameter "When pressed" via the parameterised sign. Releasing the button and a long press have no other functions.

Communication with main controller:
In order for a button parameterised as a room temperature control point to be able to perform a setpoint temperature shift on a room temperature controller, the output objects of the button must be connected to the input objects of the controller for the setpoint shift. The output object of the controller must be connected to the input object of the controller extension so that it can be shown on the display.
All objects are of the same data point type and have the same value range. A setpoint shift is interpreted by count values: a shift in positive direction is expressed by positive values whereas a shift in negative direction is represented by negative object values. An object value of "0" means that no setpoint shift has been activated.

Via the "Setpoint temperature - shift", the controller extension is enabled to determine the current setpoint shift position and to show it via the display. The controller itself checks the received value for the minimum and maximum temperature limits (see controller documentation) and adjusts the new setpoint shift if the values are valid. When the new count value is accepted as valid, the controller transfers this value to its output object for setpoint shifting and retransmits the value to the extension as positive feedback.

Due to the standard data point type used as the output and input object of the controller extension and the weighting of the individual level by the controller itself, each extension unit is able to determine whether a shift took place, in which direction it took place and by how many levels the setpoint was shifted. This requires that the communication objects are connected on all controller extensions and the controller.

The information for the step value as feedback from the controller enables the extension to continue the adjustment anytime at the right point. The extension units can likewise react to a reset of the setpoint shifting function by the controller.

11.3.3 Display functions

Indication of the controller operating mode

The controller extension can indicate the current operating mode of the controller in the display. Just like on the controller itself the operating mode is indicated by the (comfort), (standby), (night) and ❄ (frost/heat protection) icons.
A comfort extension , / , ❄ can also be shown in the display. This display information is obtained from the "Operating mode - Preset" communication objects. These objects should be connected to the main controller objects with the same function!
It is not possible to use the display information to distinguish whether the operating mode has been set via a forced object or via the ‘normal’ operating switchover. It is possible to change over the operating mode using the room temperature control point.

Indication of setpoint temperature shift

The controller extension can indicate on the display in the form of a line graphic "- - - -▼- - - -" whether a basic setpoint shift has been adjusted on the controller. Furthermore, the display shows whether the shift is active in the positive ▼"- - - -" or negative "- - - -"▼ direction. A bar corresponds to shifting by one level value. The value of a level can be parameterised in the ETS. If no shift is active, only "▼" is displayed.
In order for the indication of a basic setpoint shift to function correctly, the "Controller extension – Input / Setpoint temperature - Shift" communication object has to be connected to the object of the same function in the main controller.

For the controller extension to be able to display the setpoint shift correctly, the extension must also be configured and matched to the functions of the main controller.

Indication of setpoint temperature

The controller extension can display the setpoint temperature of the room temperature controller. If this display is desired, then the communication object "Controller extension - Input / Setpoint temperature - Active operating mode" must be linked to the functionally-identical object of the main controller. In addition, the display of the extension must be configured for the indication of the temperature setpoint. For this, display information in the "Display" parameter block must be configured to "Controller 1/2 setpoint temperature".

Indication of the heating and cooling messages

The controller extension can indicate on the display that heating and cooling energy is requested by the heating or cooling systems. This is indicated by the " " icon for heating or by the " " icon for cooling.

For the display to function, the communication objects for the controller command values of heating mode and/or cooling mode of the extension and main controller must be connected.

The command value format are strongly dependent on the parameterisation of the

main controller. For the controller extension to be able to evaluate the command value telegrams correctly, the extension must also be configured and thus matched to the functions of the main controller. These functions are matched by the following parameters in the parameter node "Controller extension"...
"Controller operating mode", "Controller transmits heating and cooling command values to a shared object" (only on
"Controller operating mode" = "Heating and cooling"), "Type of feedback control", "Controller outputs command value ... in inverted form".

Fan levels display

As on a main controller, a controller extension can also indicate the current fan level of a fan controller in the display. There is no difference in the control function of the fan symbol , , , ..., compared with the main controller function.

For the fan level indication to function, the communication object "Ventilation - fan level visualisation" must be connected to the object of the same function of the main controller.

The fan level display must be enabled on the controller extension using the "Number of fan levels" parameter. Here, it is necessary to set with how many fan levels (0...8) the main controller works.

If the standard display function is activated, it is also possible to activate the temporary fan level display for the controller extension. In this case, the status LEDs are activated for the set time of the actuation display to signal the current fan level. The status LEDs are activated in blue (see chapter "Standard display function" Page 144).

11.3.4 Behaviour after a device restart

The different indication and operating functions of the controller extension are controlled via different communication objects as described in the previous chapters. A main controller must transmit the current status to the extensions, i.e. updating the communication objects so that, after a programming operation or after the bus voltage return, all the status information is available for the initialisation of the extension. This takes place automatically for some objects during the initialisation of the main controller.

To ensure that all the objects are initialised correctly, some communication objects of the controller extension can also initialise automatically after a device restart as an option. To do this, the "Value request from controller extension" parameter in the "Room temperature control" parameter node can be set to "Active". The update takes place after a reset, then by means of a ValueRead telegram to the room temperature controller. This must answer the request with a ValueResponse telegram. If the extension does not receive all or some of the answers, the affected objects are initialised with "0". In this case, after a reset the objects must first be actively rewritten by the bus by other bus subscribers, e.g. through automatic transmission by the main controller. As a rule, this is also the case, when the "Value request from controller extension?" is set to "Inactive".

The automatic update can take place with a delay after a device reset. If there are still other bus devices besides the room controller module transmitting telegrams immediately after a reset, it may be useful to activate the transmit delay for in order to reduce the bus load.

11.3.5 Controller extension parameters

Parameters for Controller extension 1 and Controller extension 2. Both controller extensions possess the same parameters, meaning that the controller extension parameters are only documented once for both controllers.

Value request from controller extension	Active **Inactive**
To ensure that all the objects are updated correctly, some communication objects of the controller extension can also initialise automatically after a device restart. For this, this parameter can be set to "Active". The update then takes place after a reset by means of a ValueRead telegram to the room temperature controller. This must answer the request with a ValueResponse telegram.	

Controller operating mode	**Heating** Cooling Heating and cooling
As on the main controller, various items of status information of the temperature controller can be shown on the device display. As the displayed states and information very much depend on the parameterisation of the main controller, the controller extension must also be configured and thus match the functions of the main controller. If should be ensured that the settings match those of the main controller.	

Controller sends command value for heating and cooling to a shared object	Active **Inactive**
If the parameter is set to "Active", the command value will be transmitted on a shared object during heating or cooling. This function is used, if the same heating system is used to cool the room in the summer and used to heat the room in the winter. This parameter is only visible with "heating and cooling" mixed operating mode, if applicable, with additional levels.	

Type of heating control Type of cooling control	**Continuous PI control** Switching PI control (PWM) Switching 2-point feedback control
Selecting a feedback control algorithm (PI or 2-point) with data format (1-byte or 1-bit) for the heating system. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured and when the command values for heating and cooling are transmitted via two separate objects.	

Controller outputs Heating command value in inverted fashion Controller outputs Cooling command value in inverted fashion Controller outputs heating/cooling command value in inverted fashion	Active **Inactive**
At this point, depending on the controller operating mode, it is possible to specify whether the command value telegram is output normally or in inverted form.	

Controller setpoint presetting	**Relative** Absolute
Here, it is possible to specify whether the main controller is set to a relative or absolute setpoint specification.	

Controller type of shift	Via counter value x step width **Via relative temperature value**
The type of shift from the main controller is entered here. Depending on the setting of the parameter "Type of shift", the shift takes place via a 2-byte communication object (acc. to KNX DPT 9.002) or via a 1-byte communication object (acc. to KNX DPT 6.010).	

Maximum shift upwards	0 K + 1 K + 2 K + 3 K + 4 K + 5 K + 6 K + 7 K **+ 8 K** + 9 K + 10 K
This is used to define the maximum range in which the basic setpoint temperature can be adjusted upwards. This parameter is only visible with relative setpoint presetting and shift via relative temperature value.	

Maximum shift downwards	0 K - 1 K - 2 K - 3 K - 4 K - 5 K - 6 K - 7 K - 8 K - 9 K - 10 K
This is used to define the maximum range in which the basic setpoint temperature can be adjusted downwards. This parameter is only visible with relative setpoint presetting and shift via relative temperature value.	

Increment, four-level	0.5 K 1.0 K 1.5 K 2.0 K
This parameter defines the value of a level of the setpoint shift. With a setpoint shift, the basic setpoint (with relative setpoint specification) is changed by the temperature value configured here when there is an adjustment by one step in a positive or negative direction. The controller module rounds the temperature values received via the "Setpoint temperature - Basic value" object and matches the values to the step width configured here. The parameter is only available if the shift has the setting "Via counter value x step width".	

Fan controller available	Active Inactive
At this point, it is possible to specify whether a fan controller is available on the main controller.	

Number of fan levels	No fan level 1 fan level 2 fan levels **3 fan levels** 4 fan levels 5 fan levels 6 fan levels 7 fan levels 8 fan levels
The fan controller of the room temperature controller supports up to 8 fan level outputs, for which the actually used number of levels (1...8) is set using this parameter. This parameter is visible only when fan control is activated	

Controller visualisation fan level	**Value object (DPT 5.100 | 0 ... 255)** Value object (DPT 5.001 | 0 ... 100%)
The 1-byte object "Ventilation - fan level visualisation" must match the object of the main controller so that visualisation is possible.	

Object polarity	0 = automatic / 1 = manual **1 = automatic / 0 = manual**
The parameter specifies the polarity of the object for the change-over between automatic and manual fan control. Automatic mode is always active after a device reset.	

11.3.6 "Controller extension" objects

Objects for Controller extension 1 and Controller extension 2. Both controller extensions possess the same communication objects, meaning that the controller extension objects are only documented once for both controllers.

The objects of the buttons are described in the chapter Channel-orientated device functions / Room temperature control point.

Objects for the controller extension:

Function	Name	Type	DPT	Flag
Operating mode - Active mode - Status	Controller extension .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for switching a room temperature controller between the Comfort, Standby, Night and Frost/heat protection operating modes.				

Function	Name	Type	DPT	Flag
Operating mode - Forced - Status	Controller extension .. - Input	1-byte	20,102	C, -, W, T, U
1-byte object for switching a room temperature controller under forced control between the Automatic, Comfort, Standby, Night and Frost / heat protection operating modes.				

Function	Name	Type	DPT	Flag
Operating mode - Heating/cooling	Controller extension .. - Input	1-bit	1,100	C, -, W, T, U
1-byte object for switching a room temperature controller between the Comfort, Standby, Night and Frost/heat protection operating modes.				

Function	Name	Type	DPT	Flag
Setpoint temperature - Shift - Status	Controller extension .. - Input	2-byte	9,002	C, -, W, T, U
2-byte object used by the extension unit for receiving the current setpoint shift of the room temperature controller. x ≤ 0 ≤ y (0 = no shift active); integral numbers The possible range of values (x to y) is fixed within the preset limits of the setpoint (configurable).				

Function	Name	Type	DPT	Flag
Setpoint temperature - Active operating mode - Status	Controller extension .. - Input	2-byte	9,001	C, -, W, T, U
2-byte object for external setting of a setpoint for absolute setpoint presetting. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received via the object to 0.1 K. The temperature value must always be specified in the format "°C".				

Function	Name	Type	DPT	Flag
Controller status - RTSM	Controller extension .. - Input	1-byte	21,107	C, -, W, T, U
1-byte object used by the extension unit for receiving the current state of operation of the controller. Status LEDs that can be used to indicate a status independently of a button function can display one of the various information units which are grouped in this byte (bit-oriented evaluation).				

Function	Name	Type	DPT	Flag
Command value_-_Heating	Controller extension .. - Input	1-byte	5,001	C, -, W, T, U
1-byte object to output the command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "PI control".				

Function	Name	Type	DPT	Flag
Command value_-_Heating	Controller extension .. - Input	1-bit	1,001	C, -, W, T, U
1-bit object to output the switching command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Function	Name	Type	DPT	Flag
Command value_-_Cooling	Controller extension .. - Input	1-byte	5,001	C, -, W, T, U
1-byte object to output the command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "PI control".				

Function	Name	Type	DPT	Flag
Command value_-_Cooling	Controller extension .. - Input	1-bit	1,001	C, -, W, T, U
1-bit object to output the switching command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Function	Name	Type	DPT	Flag
Command value – heating/cooling	Controller extension .. - Input	1-byte	5,001	C, -, W, T, U
1-byte object to output the command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "PI control".				

Function	Name	Type	DPT	Flag
Command value – heating/cooling	Controller extension .. - Input	1-bit	1,001	C, -, W, T, U
1-bit object to output the switching command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".				

Function	Name	Type	DPT	Flag
Ventilation_-_visualisation_fan level	Controller extension .. - Input	1-byte	5,100	C, -, W, T, U
1-byte object for visualisation of the fan level. With the value object DPT 5.100 | 0 ... 255				

Function	Name	Type	DPT	Flag
Ventilation_-_visualisation_fan level	Controller extension .. - Input	1-byte	5,001	C, -, W, T, U
1-byte object for visualisation of the fan level. With the value object DPT 5.001 | 0 ... 100%				

Function	Name	Type	DPT	Flag
Ventilation - Auto / manual - Status	Controller extension .. - Input	1-bit	1,001	C, -, W, T, U
1-bit object for the status of the ventilation control. The object polarity can be set via parameters in the ETS. The default value is "1" = automatic and "0" = manual.				

Function	Name	Type	DPT	Flag
Outdoor temperature – Measured value	Controller extension .. - Input	2-byte	9,001	C, -, W, T, U
2-byte object for detecting the outdoor temperature. The received value is used solely for the display. Possible range of values: -99.9 °C to +99.9 °C. The temperature value must always be specified in the format "°C".				

Function	Name	Type	DPT	Flag
Room temperature – Actual value - Status	Controller extension .. - Input	2-byte	9,001	C, -, W, T, U
2-byte object for the detection of the actual temperature. The received value is used solely for the display. Possible range of values: -99.9 °C to +99.9 °C. The temperature value must always be specified in the format "°C".				

11.4 Room temperature measurement

Basic principles

The room temperature controller possesses an integrated temperature sensor, using which the room temperature can be detected. The TSEM offers a second option for room temperature measurement, as it also possesses an internal temperature sensor. Alternatively (e.g. if the room temperature controller has been installed in an unfavourable location or operates in difficult conditions, for example, in a moist atmosphere) or in addition (e.g. in large rooms or halls), a permanently wired remote sensor can be connected to the TSM for temperature detection. Thus, the device offers a total of three methods for room temperature measurement, which can run in parallel.

The three methods for room temperature measurement can be configured on the "Room temperature measures -> TSM", "Room temperature measurement -> TSEM" and "Room temperature measurement -> Remote sensor" parameter pages. For each method, the temperature can be detected by the internal sensor or the combination of measured temperature value (internal sensor) and received temperature value. The "Internal sensor and ext. value via bus" setting enables a communication object for receiving the temperature.

When choosing the installation location of the controller or the external sensor, the following points should be considered:

- The controller or temperature sensor should not be used in multiple combinations, especially together with flush-mounted dimmers.
- Do not install the temperature sensor in the area of large electrical consumers (avoid heat influences).
- Installation in the vicinity of radiators or cooling systems is not advisable.
- The temperature sensor should not be exposed to direct sun.
- The installation of sensors on the inside of an outside wall might have a negative impact on the temperature measurement.
- Temperature sensors should be installed at least 30 cm away from doors, windows or ventilation devices and at least 1.5 m above the floor.

Room temperature measurement by the device is active, irrespective of the "Room temperature control" or "Controller extension" functions and can thus be used independently (e.g. for simple measurement and display of a room temperature without control).

A deviation may occur in the measured temperature after a device reset or after switching on the background illumination of the display. Comparative measurements for the calibration of the room temperature measurement should take place approx. 30 minutes after a device reset or switching on the display.

Temperature detection and measured value formation

The room temperature measurement is performed via the internal sensor in the TSM, the TSEM or the remote sensor. All three sources for the room temperature offer the same setting options. The "Temperature measurement by" parameter in the "Room temperature measurement -> ..." parameter node specifies whether the room temperature is detected only via the internal sensor or by averaging with an external value via the bus.
The following settings are possible for temperature detection:

– "Internal sensor"
  The temperature sensor integrated in the device is activated. Thus, the actual temperature value is determined only locally on the device.
  In this configuration, the feedback control will start directly after a device reset.
– "internal sensor and ext. value via bus"
  This setting is used to combine the temperature sources. The sensors can either be a KNX room thermostat coupled via the
  2-byte object "External temperature" or controller extensions with temperature detection.
  When evaluating, the real actual temperature is made up from the two respective measured temperature values. The weighting of the temperature values is defined by the parameter "Weighting of measured values".
  Depending on the different locations of the sensors or a possible non-uniform heat distribution inside the room, it is also possible to adjust the actual temperature measurement. Temperature sensors that are subject to negative external influences (for example, unfavourable location because of exposure to sun or radiator or door/window in the immediate vicinity) are often weighted less heavily.

The transmission behaviour can be set with the "Transmit actual temperature" parameter. Transmission of the temperature can be set to "On change", "Cyclically" or a combination of both and can be parameterised accordingly.

Example: a room temperature controller is installed next to the entrance to the room (internal sensor). An additional wired temperature sensor has been mounted on an inner wall in the middle of the room below the ceiling. There is no further measured value via the bus.
To generate a weighting of the two temperatures, the "Remote sensor - Output" must be connected to the "TSM- Input connected" via objects.

Internal sensor: 21.5 °C
External sensor: 22.3 °C
Weighting of the measured values: 30% to 70%

-> $T_{\text{Result internal}} = T_{\text{internal}} \cdot 0.3 = 6.45\ °C$,
-> $T_{\text{Result 2}} = T_2 = 22.3\ °C \cdot 0.7 = 15.61\ °C$
-> $T_{\text{Result}} = T_{\text{Result internal}} + T_{\text{Result external}} = \underline{22.06\ °C}$

Transmission of the actual temperature

The determined actual temperature can be actively transmitted to the bus via the 2-byte "Actual temperature" object. Parameter "On change by" specifies the temperature value by which the actual value has to change until the actual temperature value is automatically transmitted via the object. Possible temperature value changes lie within a range of 0.1 K and 25.5 K. Setting to "0" at this point will deactivate the automatic transmission of the actual temperature.

In addition, the actual value can be transmitted periodically. The "Cyclically transmit the actual temperature" parameter determines the cycle time (1 to 255 minutes). The value "0" will deactivate the periodical transmission of the actual temperature value. Setting the "Read" flag on the "actual temperature" object makes it possible to read out the current actual value at any time over the bus. It has to be pointed out that with deactivated periodical transmission and deactivated automatic transmission, no more actual-temperature telegrams will be transmitted".

i If the actual temperature value is to be shown on the display, it is necessary to connect the "Temperature sensor - Actual temperature - Status" object output with the "Display - Input" "Actual temperature".

Following the bus voltage return, new programming via the ETS, the object value will be updated according to the actual temperature value and transmitted on the bus. In case a temperature value telegram has not been received from the external sensor via the object "Received temperature value" when evaluating an external temperature sensor, only the value provided by the internal sensor will be transmitted. If only the external sensor is used, then the value "0" is located in the "Actual temperature" object after a reset. For this reason, the external temperature sensor should always transmit the current value after a reset!

During room temperature control, the controller always uses the adjusted temperature value to calculate the command values. The adjusted temperature value is sent to the bus via the object "Temperature sensor - Actual temperature - Status". If necessary, the unadjusted room temperature can be additionally transmitted to the bus as an information value via the object "Actual temperature without adjustment" and, for example, be displayed in visualisations. The object for the unadjusted temperature is updated and transmitted at the same times as the "Actual temperature" object.

Calibrating the measured values

In some cases during room temperature measurement, it may be necessary to adjust the temperature values of the internal and the external sensor (received temperature value). Adjustment becomes necessary, for example, if the temperature measured by the sensors stays permanently below or above the actual temperature in the vicinity of the sensor. To determine the temperature deviation, the actual room temperature should be detected with a reference measurement using a calibrated temperature measuring device.
Using the parameters, calibration "Internal sensor (0 = inactive)" and/or calibration of "External sensor via bus (0 = inactive)" can configure the positive (temperature in-

crease, factors: 1 ... 127) or negative (temperature decrease, factors -128... -1) temperature calibration in levels of 0.1 K. Thus, the calibration is made only once statically and is the same for all operating modes of the controller.

The measured value has to be increased, if the value measured by the sensor lies below the actual room temperature. The measured value has to be decreased, if the value measured by the sensor lies above the actual room temperature.

During room temperature control, the device always uses the adjusted temperature value to calculate the command values. The adjusted temperature value is transmitted to the bus via the "Actual temperature" object (see "Transmit the actual temperature").
When determining the measured value using the internal and external sensor, the two calibrated values are used to calculate the actual value.
If necessary, the unadjusted room temperature of the internal temperature sensor can additionally be transmitted to the bus as an information value
(object "Actual temperature without calibration") and, for example, be evaluated in other bus devices or displayed in visualisations.

Temperature adjustment only affects the room temperature measurement.

11.4.1 Table of parameters

The ETS application program of the device contains three independent blocks for temperature measurement. Up to three temperatures can be determined in parallel, depending on whether the TSM is alone, is combined with a TSEM and/or with a connected remote sensor. Each temperature measurement can be performed by the internal sensor. Combined temperature recording (internal sensor + received temperature value) can also be configured.

TSM

TSEM

Remote sensor

Room temperature measurement	Inactive **Active**
On the parameter pages "TSM", "TSEM" and "Remote sensor", this parameter decides whether the module is used for room temperature measurement. When room temperature measurement is enabled, the parameters and objects are also enabled.	

Temperature measurement by	**Internal sensor** Internal sensor and ext. value via bus
This parameter specifies whether the internal sensor or an average value from the internal sensor and an external value is used for room temperature measurement. With the setting "Internal sensor" only the temperature sensor integrated in the device detects the room temperature. With the setting "Internal and external value via bus" the sensor integrated in the device and a KNX/EIB temperature sensor (e.g. controller extension) coupled via the "Temperature sensor - External value" object detect the room temperature.	

Weighting of the measured values	10% to 90% 20% to 80% 30% to 70% 40% to 60% **50% to 50%** 60% to 40% 70% to 30% 80% to 20% 90% to 10%
The weighting of the measured temperature value for the internal and external values is specified here. That results in an overall value, which will be used for the further interpretation of the room temperature.	

Internal sensor calibration (0 = inactive)	-12.8...**0**...12.7 K
Determines the value by which the internal sensor's room temperature value is calibrated. This parameter is only visible when the temperature detection system requires an internal sensor.	

External value adjustment via bus (0 = inactive)	-12.8...**0**...12.7
Determines the value by which the external sensor's room temperature value is calibrated. This parameter is only visible when the temperature detection system requires an external sensor.	

Transmit actual temperature	**On change** Cyclical Cyclical and on change
Here you can set whether the actual temperature is only sent cyclically or when there is a change by a preset value. However, the actual temperature can also be sent cyclically and when there is a change.	

On change by	0.1, **0.2** ... 25.5 K
Determines the size of the value change of the room temperature after which the current values are automatically transmitted on the bus via the "Actual temperature - Status" object.	

Cycle time	**0** ... 24 h 0 ... **5** ... 59 min **0** ... 59 s
This parameter specifies whether and when the determined room temperature is to be periodically output via the "Actual temperature - Status" object.	

11.4.2 Object list

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature - Status	TSM - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output temperature value takes the configured value for calibration into account, as well as the measured value formation between the temperature values. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F". This communication object is assigned to the room temperature measurement of the TSM. It is only enabled when the room temperature measurement of the TSM is enabled.				

Function	Name	Type	DPT	Flag
Temperature - External value	TSM - Input	2-byte	9,001	C, -, W, -, U
2-byte object for coupling an external KNX room temperature sensor. Thus cascading of multiple temperature sensors for room temperature measurement. Possible range of values: -99.9 °C to +99.9 °C. The temperature value must always be specified in the format "°C". This communication object is assigned to the room temperature measurement of the TSM. It is only enabled when the room temperature measurement of the TSM is enabled and when an "ext. value via bus" is involved in temperature detection.				

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature without calibration - Status	TSM - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output value does not take the configured value for calibration into account. Internal to external measured value formation is taken into account. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F". This communication object is assigned to the room temperature measurement of the TSM. It is only enabled when the room temperature measurement of the TSM is enabled.				

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature - Status	TSEM - Output	2-byte	9,001	C, R, -, T, A

2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output temperature value takes the configured value for calibration into account, as well as the measured value formation between the temperature values. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F".
This communication object is assigned to the room temperature measurement of the TSEM. It is only enabled when the room temperature measurement of the TSEM is enabled.

Function	Name	Type	DPT	Flag
Temperature - External value	TSEM - Input	2-byte	9,001	C, -, W, -, U

2-byte object for coupling an external KNX room temperature sensor. Thus cascading of multiple temperature sensors for room temperature measurement. Possible range of values: -99.9 °C to +99.9 °C. The temperature value must always be specified in the format "°C".
This communication object is assigned to the room temperature measurement of the TSEM. It is only enabled when the room temperature measurement of the TSEM is enabled and when a "received temperature value" is involved in temperature detection.

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature without calibration - Status	TSEM - Output	2-byte	9,001	C, -, W, T, U

2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output value does not take the configured value for calibration into account. Internal to external measured value formation is taken into account. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F".
This communication object is assigned to the room temperature measurement of the TSEM. It is only enabled when the room temperature measurement of the TSEM is enabled.

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature - Status	Remote sensor - Output	2-byte	9,001	C, -, W, T, U
2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output temperature value takes the configured value for calibration into account, as well as the measured value formation between the temperature values. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F". This communication object is assigned to the room temperature measurement of the remote sensor (RS). It is only enabled when the room temperature measurement of the RS is enabled.				

Function	Name	Type	DPT	Flag
External temperature	Remote sensor - Input	2-byte	9,001	C, -, W, -, U
2-byte object for coupling an external KNX room temperature sensor. Thus cascading of multiple temperature sensors for room temperature measurement. Possible range of values: -99.9 °C to +99.9 °C. The temperature value must always be specified in the format "°C". This communication object is assigned to the room temperature measurement of the remote sensor (RS). It is only enabled when the room temperature measurement of the RS is enabled and when a "received temperature value" is involved in temperature detection.				

Function	Name	Type	DPT	Flag
Temperature sensor – Actual temperature without calibration - Status	Remote sensor - Output	2-byte	9,001	C, -, W, T, U
2-byte object for the display of the determined actual temperature. The actual temperature is either determined by the internal sensor, a received temperature value or by a combination of both measurement methods. The output value does not take the configured value for calibration into account. Internal to external measured value formation is taken into account. Possible value range: -99.9 °C to +99.9 °C / Measuring range of internal temperature sensor: 0 °C to +40 °C. Depending on the configuration, the temperature value is output in the display of the TSM in the format "°C" or "°F". This communication object is assigned to the room temperature measurement of the remote sensor (RS). It is only enabled when the room temperature measurement of the RS is enabled.				

11.5 LED alarm signalling

The device permits signalling of an externally reported alarm via its status LED. The alarm can be triggered, for instance, in case of burglary or fire through a KNX central alarm unit. The device signals an alarm by all status LEDs of the device flashing synchronously. This alarm indication can be separately enabled with the parameter "LED alarm signalling" on the "General" parameter page.

When alarm signalling is enabled, the ETS displays the communication object "Alarm signalling" and further alarm function parameters on a separate parameter page.

The "Alarm signalling" object is used as an input for activating or deactivating the alarm signal indication. The polarity of the object can be selected. When the object value corresponds to the "Alarm" condition, all status LEDs are always flashing red with a frequency of approx. 2 Hz. If there is an alarm, the behaviour of the status LED as configured in the ETS for normal operation have no significance. The LEDs adopt their originally configured behaviour only after the alarm indication function has been deactivated. Changes of the state of the LEDs during an alarm - if they are controlled by separate LED objects or if they signal push-button functions - are internally stored and recovered at the end of the alarm.

When an indication alarm signal is active, the status LEDs of the device always flash with the regular brightness ("Brightness of all status LEDs" parameter). The device automatically deactivates the brightness reduction as long as the alarm is indicated and restores it when the alarm is switched off and the brightness reduction object is still "1"-active.

Apart from the possibility of deactivating an indication alarm via the alarm object, it can also be deactivated locally by pressing a button on the device itself. The "Reset alarm signalling by a button actuation" parameter defines the button response during an alarm:

– If this parameter is set to "Active", the active alarm signal indication can be deactivated by actuating a button on the device. This button function does not cause the configured function of the pressed button to be executed. Only after the next button is pressed will the configuration of the button be evaluated and a telegram be transmitted to the bus, if applicable.
– If "Inactive" is selected, an indication alarm can be deactivated only by means of the alarm signalling object. A button function will always directly execute the configured button function.

With the disabling function configured, alarm signalling cannot be reset by a disabled button.

If an indication alarm can be deactivated by a button actuation, the "Alarm acknowledgement object" parameter defines whether an additional alarm acknowledge telegram is to be transmitted to the bus via the separate object "Alarm signalling acknowledge" after triggering by this button actuation.

Such an acknowledge telegram can, for instance, be sent via a 'listening' group address to the "Alarm signalling" objects of other push-button sensors in order to reset the alarm status there as well. Attention must be paid during resetting of an alarm to the selectable polarity of the acknowledgement object.

If the setting is "Alarm when OFF and alarm reset when ON", the bus must actively write "0" to the alarm object in order to activate the alarm after a reset or after programming with the ETS.

An active alarm message is not stored so that the alarm indication is generally deactivated after a device reset or after programming with the ETS.

11.5.1 Table of parameters

General

LED alarm signalling	Active **Inactive**
This parameter can be used to enable alarm signal indication. When alarm signalling is enabled, the ETS displays further parameters and up to two further communication objects.	

The following parameters are visible on the "alarm signalling" parameter page if LED alarm signalling has been activated.

Polarity of the alarm signalling object	**Alarm when ON and alarm reset when OFF** Alarm when OFF and alarm reset when ON
The alarm signalling object is used as an input for activating or deactivating alarm signal indication.	

Reset alarm signalling by a button actuation	**Active** Inactive
If this parameter is set to "Active", the active alarm signal indication can be deactivated by actuating a button on the device. This button function does not cause the configured function of the pressed button to be executed. Only after the next button is pressed will the configuration of the button be evaluated and a telegram be transmitted to the bus, if applicable. If "Inactive" is selected, an indication alarm can be deactivated only by means of the alarm signalling object. A button actuation will always execute the configured button function.	

Alarm acknowledgement object	Active **Inactive**
If an indication alarm can be deactivated by a button actuation, this parameter defines whether an additional alarm acknowledge telegram is to be transmitted to the bus via the separate object "Alarm signalling acknowledge" after triggering by this button actuation.	

Acknowledge alarm signalling by	ON telegram **OFF telegram**
This parameter sets the polarity of the "Alarm signalling acknowledge" object. This parameter presetting depends on the selected polarity of the alarm message object.	

11.5.2 Object list

Function	Name	Type	DPT	Flag
Alarm signal	Alarm signalling - Input	1-bit	1,001	C, -, W, -, U
1-bit object for the reception of an alarm signalling (polarity configurable).				

Function	Name	Type	DPT	Flag
Alarm message acknowledge	Alarm signalling - Output	1-bit	1,001	C, -, -, T, U
1-bit object for transmitting the acknowledgement of an alarm signalling (polarity configurable).				

11.6 Brightness reduction

Optionally, the brightness of the status LED can be changed during operation of the push-button sensor, controlled by the brightness reduction. The brightness reduction also affects the brightness of the display. A parameter appears on the "Display - Module" parameter page that can also be used to set any reduced brightness for the display. Changing may be advisable, for example, to reduce the brightness during nighttime hours. If switching the brightness by means of the object is required, "brightness reduction" must be activated on the "General" parameter page. In this case, the "brightness reduction" communication object will become visible in the ETS. As soon as a "1" telegram is received via this object, the push-button sensor switches over to the "Reduced brightness at push-button sensor basic module" configured in the ETS ("Brightness reduction" parameter page). If a "0" telegram is received via the object, the push-button sensor switches back to regular brightness.

The LED brightness is always changed gently by means of a brief dimming process. Dimming with a higher increment value results in quicker dimming than with dimming at a lower increment value. This results in a slow soft dimming that is pleasing for the human eye. The dimming speeds are fixed and therefore not changeable.

In the ETS it is possible to perform configuration in accordance with the possible selection of required stage values for the regular and reduced brightness. No check is made whether a reduced brightness level is configured for the lower brightness level. This also makes it possible to use the object to switch over the object to larger brightness levels in comparison to the regular brightness. It is advisable to set the brightness value for the brightness reduction to a lower level than regular brightness.

After a button has been actuated while brightness reduction is active, the illuminated LEDs of the device or the display can be controlled to light up with regular brightness for 30 seconds. This behaviour can be activated or deactivated using the "Brightness increase for 30 seconds" parameter. Increasing the brightness, especially with significantly reduced brightness values or LEDs even switched off, permits status changes to be identified more easily (or identified at all) in night mode. This function is only available with TSM.

After a device reset, the regular brightness for switched-on LEDs is always effective. A switch-over by brightness reduction will only take place when a telegram is written to the respective object after a reset.

When the status LED is activated via the regular display function or via the superposed function, it is possible to let the status LED flash. During flashing the LEDs switch synchronously between the "switched-on" and "switched-off" states in the active brightness. This is not interpreted as a change of state of the display function, by means of which the brightness is therefore also not switched over automatically.

When LED alarm signalling is active, the status LEDs of the push-button sensor always flash with the regular brightness. The push-button sensor automatically deactivates the brightness reduction as long as the alarm LED is on and restores it when the alarm LED is switched off and the brightness reduction object is still "1"-active.

11.6.1 Table of parameters

"Configuration TSM/TSEM" parameter page

Brightness reduction	Active **Inactive**
The brightness reduction can be enabled here. If the brightness reduction is enabled, the ETS will show further parameters and another communication object.	

The following parameters are visible on the "Brightness reduction" parameter page when brightness reduction is activated.

Object polarity	**1 = active / 0 = not active** 0 = active / 1 = not active
The brightness reduction object is used as an input for activating or deactivating the brightness reduction. This object defines the polarity of the "Activate/deactivate brightness reduction" object.	

Status LED: reduced brightness at push-button sensor basic module	Level 0 (OFF) Level 1 (dark) **Level 2** Level 3 Level 4 Level 5 (bright)
The brightness of all status LEDs of the push-button sensor can be defined on the "Brightness reduction" parameter page. The illumination brightness of all LEDs with active brightness reduction can be set here in 6 levels.	

Increase brightness for 30 seconds	**Active** Inactive
Here, the brightness increase can be enabled for 30 seconds after a button has been actuated. The TSM then switches the brightness of the status LED to its normal brightness.	

11.6.2 Object list

Function	Name	Type	DPT	Flag
Activate/deactivate	Brightness reduction - Input	1-bit	1,001	C, -, W, -, -
1-bit object for activating or deactivating the brightness reduction (changed brightness of all LEDs). This makes it possible, for example, to reduce the brightness during night time to a value configured in the ETS ("1" = brightness reduction ON; "0" = brightness reduction OFF).				

11.7 Scene function

The device can be used in two different ways as part of a scene control:

– Each rocker or button can work as a scene extension. This feature makes it possible to recall or to store scenes which may be stored in other devices Scene extension.
– The push-button sensor can independently store up to eight scenes with eight actuator groups. These internal scenes can be recalled or stored by the rockers or buttons (internal scene recall) and also by the "extension" communication object.
  In the following subsections the internal scene function will be dealt with in greater detail.

11.7.1 Storing scenes

For each output of a scene, the user can define a corresponding scene value in the ETS which is then transmitted to the bus during a scene recall. During the ongoing operation of the system it may be necessary to adapt these preset values and to save the adapted values in the push-button sensor. This can be ensured by the storage function of the scene control.

The value storage function for the corresponding scene number is activated or deactivated with the parameter "Permit storage". When the storage function is disabled, the object value of the corresponding output is not sampled during storage.

A scene storage process can be initiated in two different ways:

– by long actuation of a rocker or button of an operating element configured as "scene extension"
– by a storage telegram to the extension object.

During a storage process, the push-button sensor reads the current object values of the connected actuators. This is carried out by means of eight read telegrams (ValueRead) addressed to the devices in the scene which return their own value (ValueResponse) as a reaction to the request. The returned values are received by the push-button sensor and taken over permanently into the scene memory. Per scene output, the push-button sensor waits one second for a response. If no answer is received during this time, the value for this scene output remains unchanged and the push-button sensor scans the next output.

In order to enable the push-button sensor to read the object value of the actuator addressed when a scene is stored, the read flag of the corresponding actuator object must be set. This should be done only for one actuator out of an actuator group so that the value response is unequivocal.

The stored values overwrite those programmed into the push-button sensor with the ETS.

The storage process will always be executed completely by the push-button sensor and cannot not be aborted before it has ended. No scenes can be recalled during a storage process, however the operating elements of the push-button sensor can be operated normally.

11.7.2 Scene definition and scene recall

Scene definition and scene recall

If the internal scenes are to be used, the "Scene function" parameter on the "General" parameter page must be set to "Activated". When the scene function is activated, the ETS automatically shows the "Scene function" parameter page. The matching data types for the eight scene outputs must then be selected on the "Scene data types" parameter page and adapted to the actuator groups used. The following types are available for selection:

– Switching
– Value (0…255)
– Value / shading position (0…100%)
– Colour temperature value
– Colour value RGB/HSV
– Colour value RGBW/HSVW

As a rule, Venetian blinds are controlled via two scene outputs. One output controls the blind height and the other one adjusts the slat position.

The ETS sets the corresponding communication objects and the parameters of the scene commands on the following parameter pages "Scene 1" to "Scene 8".

It is possible that the values for the individual scenes preset by the parameters are changed later on when the system is in operation with the storage function "Save scenes". If the application program is then loaded again with the ETS, these locally adapted values will normally be overwritten by the parameters. Due to the fact that it may take considerable efforts to readjust the values for all scenes in the system, the parameter "Overwrite scene values during ETS download" offers the possibility of not overwriting the scene values stored in operation.

The scene parameters can be set on the parameter page of each individual scene ("Scene 1 ... 8"). The setting options are the same for all 8 scenes.

These internal scenes can be recalled directly via the rockers or buttons (function "scene extension") and also by another bus device via the "Extension" communication object. This 1-byte communication object supports the evaluation of up to 64 scene numbers. For this reason, it must be specified in ETS which of the external scene numbers (1 … 64) is to recall the internal scene (1 … 8). If the same scene number is listed for several internal scenes, it is always only the first of these scenes that will be activated (scene with the lowest scene number).

In some situations there may be the requirement that a group of actuators is not controlled by all, but only by certain scenes. A classroom, for instance, may require open blinds for the "Welcome" and "Break" scenes, closed blinds in the "PC presentation" scene and no change in the "Discussion" scene. In this example, the parameter "Permit transmission" for the "Meeting" scene can be set to "Inactive". The scene output is then deactivated during the corresponding scene.

The parameter "Transmit delay" permits entering an individual waiting time for each scene output. This transmit delay can be used in different situations:

– When the actuators participating in a scene transmit status messages automatically or when several scene buttons are used to increase the number of channels within the scenes, the recall of a scene may result for a short time in high bus loading. The transmit delay helps to reduce the bus load at the time of scene recall.
– Sometimes, it is desirable that an action is started only after another action has ended. This can be for instance the illumination which is to shut off only after the blinds/shutters have been raised.

The transmit delay can be set separately for each scene output. The transmit delay defines the time delay between the individual telegrams during a scene recall. The setting specifies how much time must pass after the first scene telegram before the second is transmitted. After transmission of the second scene telegram, the configured time must again pass before the third is transmitted. The delay continues as follows for each additional scene telegram. The transmit delay for the first scene telegram starts immediately after the scene has been recalled.

The transmit delay between telegrams can also be deactivated (setting "0"). The telegrams are then transmitted at the shortest possible time interval. In this case, however, the order of the telegrams transmitted can deviate from the numbering of the scene outputs.

When a new scene recall (also with the same scene number) occurs during a current scene recall - even in consideration of the pertaining transmit delays - the scene processing started first will be aborted and the newly received scene number will be processed. A running scene is also aborted when a scene is being stored!

During a scene recall - even if delayed - the operating areas of the push-button sensor are normally operational.

11.7.3 Table of parameters

General

Scene function	Active **Inactive**
The device can internally handle eight scenes with eight actuator groups. This parameter activates the scene function and the other parameters and communication objects, if needed.	

Scene function -> Scene data types

Overwrite scene values during ETS download	**Active** Inactive
If the values of the actuator groups that have been changed on site by the user are to be reset to the values preset in the ETS during an application download by the ETS, the setting must be activated. If the setting is deactivated the ETS values will not overwrite any scene values stored in the push-button sensor.	

Scene output *n*	**Switching** Value (0…255) Value / shading position (0…100%) Colour temperature value Colour value RGB/HSV Colour value RGBW/HSVW
The push-button sensor has an independent communication object for each of the eight actuator groups. With these parameters, the object type can be set separately for each output.	

Colour space	**RGB** HSV
This parameter defines the colour space when the scene output executes the "Colour value RGB/HSV" function. With RGB, communication can take place via individual objects or via a combination object. With HSV, communication takes place via individual objects.	

Communication	**Individual objects** Combi object
When the colour space is set to RGB, communication via the bus can take place either via individual objects (red, green, blue) or via a combination object (RGB).	

Colour space	**RGBW** HSVW
This parameter defines the colour space when the scene output executes the "Colour value RGBW/HSVW" function. With RGBW, communication can take place via individual objects or via a combination object. With HSVW, communication takes place via individual objects. This parameter is only visible if "Value range = colour value RGBW/HSVW"	

Communication	**Individual objects** Combi object
When the colour space is set to RGBW, communication via the bus can take place either via individual objects (red, green, blue, white) or via a combination object (RGBW).	

Scene function -> Scene *n*

Name	Scene *n* max. 40 characters long text
This parameter gives the scene a name for identification. This name serves merely as an aid in the ETS and is not programmed into the device.	

Scene number	**1** ... 64
If the internal scenes are to be recalled via the extension object, a definite number is required for each of them. This parameter is for specifying the extension number of the corresponding scene. If several internal scenes have the same scene number, only the first scene with this number can be called up.	

The following parameters must be set on each "Scene n" parameter page for scene outputs 1 to 8, depending on the selected data type.

Switching command	**ON** OFF
This parameter can be used to predefine the switching command of the scene output. This parameter is only visible if "Data types scene output n = switching"!	

Value (0 … 255)	**0**...255
This parameter can be used to predefine the value of the scene output. This parameter is only visible if "Data types scene output n = value (0 … 255)"!	

Value / blind/shutter position (0 ... 100%)	**0**...100
This parameter can be used to predefine the value of the scene output. This parameter is only visible if "Data types scene output n = value / blind/shutter position (0 ... 100%)"!	

Colour temperature (1000, 1100, ..., 10000 K)	1000, 1100, ..., **2700**, ..., 10000

This parameter can be used to predefine the value of the scene output.

This parameter is only visible if "Data types scene output n = colour temperature value"!

Value (RGB/HSV)	#000000 ... **#FFFFFF**

This parameter can be used to predefine the value of the scene output.

The value (RGB/HSV) is configured by means of a colour picker.

This parameter is only visible if "Data types scene output n = colour value RGB/HSV" and "Data types scene output n = colour value RGBW/HSVW"!

With "Data types scene output n = colour value RGBW/HSVW", the W-value is configured using a separate slider.

Value (W)	**0** ... 255

This parameter can be used to predefine the value of the scene output.

This parameter is only visible if "Data types scene output n = colour value RGBW/HSVW"!

Allow save	**Active** Inactive

If the user is to be given the possibility of changing the value of the actuator group (scene output) within this scene and of storing it during regular operation, this parameter must be set to "activated".

Allow transmission	**Active** Inactive

If the state of an actuator group is to remain unchanged during the recall of a scene, this parameter can be set to "Inactive". In this case, the push-button sensor does not transmit a telegram via the scene output concerned during the recall of the scene. The scene output is deactivated for this scene.

Transmission delay	**0**...120000 ms

When the push-button sensor sends the telegrams to the various scene outputs, it can insert a presettable waiting time of 2 min. max. before each telegram. This parameter sets the time in 100 millisecond increments.

This can be used to reduce bus loading, but also to have certain lamps switched on only after the shutters are really closed.

If no delay is selected ("0"), the push-button sensor sends the output telegrams with maximum speed. With this setting it may happen in some cases that the telegram sequence is not compatible with output numbering.

11.7.4 Object list

The following communication objects are available for the individual scene outputs, depending on the set data type. The name of the object can be specified by the parameter "Name".

Function	Name	Type	DPT	Flag
Extension	Scenes - input	1-byte	18,001	C, -, W, -, U
1-byte object for recalling or for storing one of 64 scenes max. from a scene push-button sensor.				

Function	Name	Type	DPT	Flag
Switching	Scene - Scene output *n*	1-bit	1,001	C, -, W, T, U
1-bit objects for controlling up to eight actuator groups (ON, OFF).				

Function	Name	Type	DPT	Flag
Value (0...255)	Scene - Scene output *n*	1-byte	5,010	C, -, W, T, U
1-byte objects for controlling up to eight actuator groups (0…255).				

Function	Name	Type	DPT	Flag
Value / shading position (0…100%)	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour temperature value	Scene - Scene output *n*	2-byte	7,600	C, -, W, T, U
2-byte object for transmitting colour temperature values from 1000 to 10000 Kelvin, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value RGB	Scene - Scene output *n*	3-byte	232,600	C, -, W, T, U
3-byte object for transmitting the colour information red, green and blue in one communication object, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value RGBW	Scene - Scene output *n*	6-byte	251,600	C, -, W, T, U
6-byte object for transmitting the colour information red, green, blue and white in one communication object, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value Red	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the red colour value from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value Green	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the green colour value from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value Blue	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the blue colour value from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour value White	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the white colour value from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Colour hue (H)	Scene - Scene output *n*	1-byte	5,003	C, -, W, T, U
1-byte object for sending the colour hue (H) from 0 ... 360°, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Saturation (S)	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the saturation (S) from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
Brightness (V)	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the brightness value (V) from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

Function	Name	Type	DPT	Flag
White value (W)	Scene - Scene output *n*	1-byte	5,001	C, -, W, T, U
1-byte object for transmitting the white value (W) from 0 to 100 per cent, with which one of the eight internally stored scenes can be recalled or stored again.				

11.8 Locking function

Configuration

With the 1-bit communication object "Disabling", the operating areas of the device can be partly or completely disabled. During a disable, the rockers or buttons can also temporarily execute other functions.

ℹ An active disable applies only to the functions of the rockers or buttons. The functions of the status LED and the temperature measurement are not affected by the disabling function.

ℹ With alarm signalling configured, the alarm signalling indication cannot be reset by a disabled button.

The disabling function and the associated parameters and communication objects are enabled if the "Disabling function" parameter on the "General" parameter page is set to "Active".

You can parameterise the polarity of the disabling object. In case of polarity inversion (disabled = 0 / enabled = 1), the disabling function is not activated immediately after a bus reset or after ETS programming (object value = "0"). There must first be an object update "0" until the disabling function will be activated. Telegram updates from "0" to "0" or from "1" to "1" on the "Disabling" object remain without effect.

ℹ After a device reset, the disabling function is deactivated and must be activated via the bus.

Configuring the reaction at the beginning and end of a disable

If the disabling function is used, the reaction of the push-button sensor on activation and deactivation of the disabling function can be preset separately in the parameterisation (parameter "At the beginning of the disabling function / At the end of the disabling function"). In this connection it is irrelevant which of the control surfaces is influenced and possibly also locked by disabling. The push-button sensor always shows the configured behaviour.

Prerequisite: The disabling function must have been enabled in advance.

– Set parameter "At the beginning of the disabling function / At the end of the disabling function" to "no reaction".
  The push-button sensor (TSM + TSEM) shows no reaction at the beginning and at the end of disabling. Only the behaviour "Behaviour during active disabling" is executed.
– Set the "At the start of disabling / At the end of disabling" parameter to "Retrieve internal scene 1 ...8".
  The push-button sensor (TSM + TSEM) recalls one of the up to 8 internal scenes. Scene storage is not possible.
– Set parameter "At the beginning of the disabling function / At the end of the disabling function" to "Reaction as button >> X << / >> Y << when pressed / released".
  The device (TSM + TSEM) executes the function assigned to any "target but-

ton" in non-disabled state. Target buttons are operating buttons of the push-button sensor on the basic device as well as on the extension module, which may be configured for rocker or for button operation. The target buttons are configured separately for the beginning (X) of for the end (Y) of disabling (button X / Y: button 1 to max. button 16). Both buttons of a rocker are treated as two separate buttons.
The action configured for the respective target button is executed. If the target button is configured in such a way that it has no function or does not transmit a telegram on pressing or releasing of the button, or a module button is configured without an extension module being connected to the basic device, then there is also no reaction to disabling or to re-enabling. If the selected target button is part of a configured rocker, the behaviour preset for the respective rocker side will be used. The telegrams are transmitted to the bus via the required communication object of the target button.
The following table shows all possible telegram reactions of the pushbutton sensor with respect to the target button function.

– Set parameter "At the beginning of the disabling function / At the end of the disabling function" to "Reaction as disabling function 1 / 2 when pressed / released".
  The device (TSM + TSEM) executes the function assigned to either of the two "virtual" disabling functions. The disabling functions are internal button functions with independent communication objects and independent parameters. Except for the status LED, the setting possibilities available for disabling function 1 and disabling function 2 are the same as for the buttons.
  The respective configuration of the predefined disabling function will be executed. If no function or no telegram is configuration in the disabling function on pressing or releasing of a button, then there is also no reaction to disabling or to re-enabling.
  Also, for this setting, Table 1 shows all possible telegram reactions of the push/button sensor depending on the project design of the disabling function. The telegrams are transmitted to the bus via the required communication object of the disabling function.

Configuring the reaction during a disable

In an active disable, either all buttons of the device or only individual buttons may be affected by the disable. You can furthermore define in the ETS whether disabled buttons will not show any response when pressed or, alternatively, will behave like another button of the device. This can be used to limit the control function of the device completely or partially.

Precondition: The disabling function must be activated.

– Set the parameter "Behaviour in the event of active disabling" to "all buttons without function".
  The disabled buttons do not respond when pressed. The status LEDs of the disabled buttons remain off if the display function is configured to "Button-actuation display" or "Telegram acknowledgement".

– Set the parameter "Behaviour in the event of active disabling" to "All buttons behave like". Also configure the parameters "All uneven buttons behave like" and "All even buttons behave like" to the desired button number or disabling function as a reference button.
  All buttons assigned to the disabling function behave as defined in the parameters for the two specified reference buttons of the device. Different or identical reference buttons can be configured separately for all uneven and even buttons. The two 'virtual' disabling functions of the device can also be configured as a reference button.
  The telegrams are transmitted to the bus via the communication objects of the specified reference buttons. The status LEDs of the reference buttons are controlled according to their function. The status LEDs of the disabled buttons remain off if the display function is configured to "Button-actuation display" or "Telegram acknowledgement".
– Set the parameter "Behaviour in the event active disabling" to "Individual buttons without function". A "Button assignment“ parameter page appears, on which the individual buttons can be selected.
  The disabling function affects only the buttons assigned on the "Button assignment" parameter page. As soon as one of the assigned buttons of the device is pressed while a disabling function is active, the device will not execute any function. All other, non-disabled buttons respond normally when pressed.
– Set the parameter "Behaviour in the event of active disabling" to "Individual buttons behave like". A "Button assignment“ parameter page appears, on which the individual buttons can be selected. Also configure the parameters "All uneven buttons behave like" and "All even buttons behave like" to the desired button number or disabling function as a reference button.
  The disabling function affects only the buttons activated on the "Button assignment" parameter page. As soon as one of the assigned buttons is pressed while a disabling function is active, the "Behaviour when a disabling function is active" for this button is executed. All other, non-disabled buttons respond normally when pressed. Different or identical reference buttons can be configured separately for all uneven and even buttons. The two 'virtual' disabling functions of the device can also be configured as a reference button.
  The telegrams are transmitted to the bus via the communication objects of the specified reference buttons. The status LEDs of the reference buttons are controlled according to their function. The status LEDs of the disabled buttons remain off if the display function is configured to "Button-actuation display" or "Telegram acknowledgement".

i If a button evaluation is taking place at the time of activation / deactivation of a disabling function, this function is aborted immediately and with it also the pertaining button function. It is first necessary to release all buttons before a new button function can be executed if so permitted by the state of disabling.

11.8.1 Table of parameters

The same functions, parameters and settings as in the push-button sensor basic module TSM are available for the push-button sensor extension module TSEM. Thus, the settings in the extension module are independent of the settings in the basic module.

General

Locking function	Active **Inactive**
With this parameter, the disabling function of the device can be centrally activated. If "Active", the ETS shows further communication object and parameters.	

Locking function

Object polarity	0 = enable / 1 = disable **1 = enable / 0 = disable**
This parameter defines the value of the disabling object at which the disabling function is active.	

At the beginning of the disabling function	**No reaction** Reaction as button *>>X<<* when pressed Reaction as button *>>X<<* when released Reaction as disabling function 1 when pressed Reaction as disabling function 1 when released Reaction as disabling function 2 when pressed Reaction as disabling function 2 when released Retrieve internal scene 1 Retrieve internal scene 2 Retrieve internal scene 3 Retrieve internal scene 4 Retrieve internal scene 5 Retrieve internal scene 6 Retrieve internal scene 7 Retrieve internal scene 8

Besides disabling of rocker and button functions, the device can also trigger a specific function immediately at the time of activation of the disabling state.

This function can:

- correspond to the function assigned to any button in the non-disabled state when pressed or released ("Reaction as button *>>X<<* …")
- correspond to one of two disabling functions, which are to be defined on the following parameter pages ("Reaction as disabling function 1 or 2 when pressed or released").
- retrieve one of the 8 internal scenes. However, the internal scenes are only visible if "Scene function" is enabled on the "General" parameter page.

Behaviour during active disabling	**All buttons without function** All buttons behave as Individual buttons without function Individual buttons behave as

You can define here whether disabled buttons will not show any response when pressed or, alternatively, will behave like another button of the device or like a virtual disabling function. This can be done for all buttons or for individual buttons selected from the "Button assignment" parameter page.

"All buttons have no function": The disabled buttons do not respond when pressed.

"All buttons behave like": The disabled buttons can either execute the function of a button that has already been configured or the function of a separate disabling function. The parameters "All uneven buttons behave like" and "All even buttons behave like" define the function of the buttons assigned to the disabling function.

"Individual buttons without function" or "Individual buttons behave like": The disabling function applies only to the assigned buttons. As soon as one of the assigned buttons is pressed while a disabling function is active, the "Behaviour when a disabling function is active" for this button is executed. All other, non-disabled buttons respond normally when pressed.

All uneven buttons behave like	**TSM - Button 1** TSM - button n TSEM - Button 1 TSEM - button n (Selection depends on device variant!) Disabling function 1 Disabling function 2

If a specific button function is to be assigned during disabling to all or to individual buttons, this parameter can be used to select the desired button the function of which will then be executed. During disabling, all buttons with odd numbers behave like the ones configured here.

The desired functions can either correspond to the function of an existing button or they can be configured as special disabling functions.

This parameter is visible only if "Behaviour with active disabling function" = "All buttons behave like" or "Individual buttons behave like"!

All even buttons behave like	**TSM - Button 1** TSM - button n TSEM - Button 1 TSEM - button n (Selection depends on device variant!) Disabling function 1 Disabling function 2

If a specific button function is to be assigned during disabling to all or to individual buttons, this parameter can be used to select the desired button the function of which will then be executed. During disabling, all buttons with even numbers behave like the one configured here.

The desired functions can either correspond to the function of an existing button or they can be configured as special disabling functions.

This parameter is visible only if "Behaviour with active disabling function" = "All buttons behave like" or "Individual buttons behave like"!

At the end of the disabling function	**No reaction** Reaction as button *>>Y<<* when pressed Reaction as button *>>Y<<* when released Reaction as disabling function 1 when pressed Reaction as disabling function 1 when released Reaction as disabling function 2 when pressed Reaction as disabling function 2 when released Retrieve internal scene 1 Retrieve internal scene 2 Retrieve internal scene 3 Retrieve internal scene 4 Retrieve internal scene 5 Retrieve internal scene 6 Retrieve internal scene 7 Retrieve internal scene 8

Besides disabling of rocker and button functions, the push-button sensor can also trigger a special function immediately at the end of disabling.

This function can:

- correspond to the function assigned to any button in the non-disabled state when pressed or released ("Reaction as button *>>Y<<* …")
- correspond to one of two disabling functions, which are to be defined on the following parameter pages ("Reaction as disabling function 1 or 2 when pressed or released").
- retrieve one of the 8 internal scenes.

Disabling function -> Assignment of the buttons (only visible with "Behaviour with active disabling" = "individual buttons behave like")

Button assignment TSM - Button 1 TSM - Button 2 … TSEM - button 8 (TSEM - if present)*	Active **Inactive**

The user can specify for each button separately whether it will be affected by the disabling function during the disabling state.

*: The number of buttons depends on the configured pushbutton sensor variant! Moreover, the extension module buttons can only be selected here if a corresponding extension module is also connected to the basic device.

Disabling function -> Disabling function 1 / Disabling function 2

i The functions "switching", "dimming", "venetian blind", "value transmitter", "scene extension", "short and long button actuation" and "room temperature control point" are available for the two disabling functions. These functions behave like the button functions of the device (same parameters).

11.8.2 Object list

Function	Name	Type	DPT	Flag
Disabling	Disabling function - input	1-bit	1,002	C, -, W, -, U
1-bit object for transmission of switching telegrams (ON, OFF).				

Disabling function: Switching

Function	Name	Type	DPT	Flag
Switching	Disabling function *n* - Output	1-bit	1,001	C, R, -, T, A
1-bit object for transmission of switching telegrams (ON, OFF).				

Function	Name	Type	DPT	Flag
Switching - Status	Disabling function *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object for receiving feedback telegrams (ON, OFF).				

Disabling function: Dimming and colour temperature

Function	Name	Type	DPT	Flag
Dimming - Switching	Disabling function *n* - Output	1-bit	1,001	C, R, -, T, A
1-bit object for transmission of switching telegrams (ON, OFF).				

Function	Name	Type	DPT	Flag
Dimming	Disabling function *n* - Output	4-bit	3,007	C, R, -, T, A
4-bit object for the transmission of relative dimming telegrams.				

Function	Name	Type	DPT	Flag
Dimming - Colour temperature fading	Disabling function *n* - Output	4-bit	3,007	C, R, -, T, A
4-bit object used to send relative colour temperature telegrams.				

Function	Name	Type	DPT	Flag
Dimming - Brightness and colour temperature	Disabling function *n* - Output	3-byte	250,600	C, R, -, T, A
4-bit object used to send relative brightness and colour temperature telegrams.				

Disabling function: Venetian blind / shutter / awning / skylight

Function	Name	Type	DPT	Flag
Venetian blind - Short time operation	Disabling function *n* - Output	1-bit	1,007	C, R, -, T, A
1-bit object for the transmission of telegrams with which a venetian blind or shutter drive motor can be stopped or with which the blind slats can be adjusted by short time operation.				

Function	Name	Type	DPT	Flag
Venetian blind - Long time operation	Disabling function *n* - Output	1-bit	1,008	C, R, -, T, A
1-bit object for the transmission of telegrams with which a venetian blind or shutter drive motor can be can be moved upwards or downwards.				

Disabling function: Value transmitter

Function	Name	Type	DPT	Flag
Value transmitter - 0...100%	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object for the transmission of values from 0 to 100%.				

Function	Name	Type	DPT	Flag
Value transmitter - 0...255	Disabling function *n* - Output	1-byte	5,010	C, R, -, T, A
1-byte object for the transmission of values from 0 to 255.				

Function	Name	Type	DPT	Flag
Value transmitter - 0...360°	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object for the transmission of values from 0 to 360°.				

Function	Name	Type	DPT	Flag
Value transmitter - 0...255%	Disabling function *n* - Output	1-byte	5,004	C, R, -, T, A
1-byte object for the transmission of values from 0 to 255%.				

Function	Name	Type	DPT	Flag
Value transmitter -128...127	Disabling function *n* - Output	1-byte	6,010	C, R, -, T, A
1-byte object for the transmission of values from -128 to 127.				

Function	Name	Type	DPT	Flag
Value transmitter - 0...65535	Disabling function *n* - Output	2-byte	7,001	C, R, -, T, A
2-byte object for the transmission of values from 0 to 65535.				

Function	Name	Type	DPT	Flag
Value transmitter - Colour temperature value	Disabling function *n* - Output	2-byte	7,600	C, R, -, T, A
2-byte object for transmitting colour temperature values from 1000 to 10000 Kelvin.				

Function	Name	Type	DPT	Flag
Value transmitter -32768...32767	Disabling function *n* - Output	2-byte	8,001	C, R, -, T, A
2-byte object for the transmission of values from -32768 to 32767.				

Function	Name	Type	DPT	Flag
Value transmitter - Temperature value	Disabling function *n* - Output	2-byte	9,001	C, R, -, T, A
2-byte object for transmitting temperature values from 0 to 40 °C.				

Function	Name	Type	DPT	Flag
Value transmitter - Brightness value	Disabling function *n* - Output	2-byte	9,004	C, R, -, T, A
2-byte object for transmitting brightness values from 0 to 1500 Lux.				

Function	Name	Type	DPT	Flag
Value transmitter - Colour temperature value and brightness value	Disabling function *n* - Output	6-byte	249,600	C, R, -, T, A
6-byte object used to send colour temperature and brightness information.				

Function	Name	Type	DPT	Flag
Value transmitter - RGB/HSV (colour wheel sequence)	Disabling function *n* - Output	3-byte	232,600	C, R, -, T, A
3-byte object for transmitting 3-byte colour information.				

Function	Name	Type	DPT	Flag
Value transmitter - RGBW -	Disabling function *n* - Output	6-byte	251,600	C, R, -, T, A
6-byte object for transmitting 6-byte colour information.				

Function	Name	Type	DPT	Flag
Value transmitter - Colour hue (H)	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object for transmitting the colour hue.				

Function	Name	Type	DPT	Flag
Value transmitter - Saturation (S)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object for transmitting the saturation.				

Function	Name	Type	DPT	Flag
Value transmitter - brightness value (V)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object for transmitting the brightness value.				

Function	Name	Type	DPT	Flag
Value transmitter - White value (W)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object for transmitting the brightness value.				

Disabling function: Scene extension

Function	Name	Type	DPT	Flag
Scene extension - Scene number	Disabling function *n* - Output	1-byte	18,001	C, R, -, T, A
1-byte object for recalling or for storing one of 64 scenes max. from a scene push-button sensor.				

Disabling function: Short and long button actuation

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Switching	Disabling function *n* - Output	1-bit	1,001	C, R, -, T, A
1-bit object used to send switching telegrams by briefly pressing the button (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Switching	Disabling function *n* - Output	1-bit	1,001	C, R, -, T, A
1-bit object used to send switching telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Switching - Status	Disabling function *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object used to receive switching telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Switching - Status	Disabling function *n* - Input	1-bit	1,001	C, -, W, -, U
1-bit object used to receive switching telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...100%	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...100%	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short button actuation - Object 1 - Value 0...255	Disabling function *n* - Output	1-byte	5,010	C, R, -, T, A
1-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...255	Disabling function *n* - Output	1-byte	5,010	C, R, -, T, A
1-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...360°	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...360°	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...255%	Disabling function *n* - Output	1-byte	5,004	C, R, -, T, A
1-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...255%	Disabling function *n* - Output	1-byte	5,004	C, R, -, T, A
1-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value -128...127	Disabling function *n* - Output	1-byte	6,010	C, R, -, T, A
1-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value -128...127	Disabling function *n* - Output	1-byte	6,010	C, R, -, T, A
1-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value 0...65535	Disabling function *n* - Output	2-byte	7,001	C, R, -, T, A
2-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value 0...65535	Disabling function *n* - Output	2-byte	7,001	C, R, -, T, A
2-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Value -32768...32767	Disabling function *n* - Output	2-byte	8,001	C, R, -, T, A
2-byte object used to send value telegrams by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Value -32768...32767	Disabling function *n* - Output	2-byte	8,001	C, R, -, T, A
2-byte object used to send value telegrams by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Temperature value	Disabling function *n* - Output	2-byte	9,001	C, R, -, T, A
2-byte object used to send temperature values by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Temperature value	Disabling function *n* - Output	2-byte	9,001	C, R, -, T, A
2-byte object used to send temperature values by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Brightness value	Disabling function *n* - Output	2-byte	9,004	C, R, -, T, A
2-byte object used to send brightness values by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Brightness value	Disabling function *n* - Output	2-byte	9,004	C, R, -, T, A
2-byte object used to send brightness values by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Scene number 1...64	Disabling function *n* - Output	1-byte	18,001	C, R, -, T, A
1-byte object used to send scene values by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Scene number 1...64	Disabling function *n* - Output	1-byte	18,001	C, R, -, T, A
1-byte object used to send scene values by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - RGB colour value	Disabling function *n* - Output	3-byte	232,600	C, R, -, T, A
1-byte object used to send scene values by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - RGB colour value	Disabling function *n* - Output	3-byte	232,600	C, R, -, T, A
1-byte object used to send scene values by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Colour hue (H)	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send the colour hue by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Colour hue (H)	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send the colour hue by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Saturation (S)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the saturation by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Saturation (S)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the saturation by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Brightness value (V)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the brightness by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Brightness value (V)	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the brightness by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Red colour value	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send the red colour value by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Red colour value	Disabling function *n* - Output	1-byte	5,003	C, R, -, T, A
1-byte object used to send the red colour value by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Green colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the green colour value by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Green colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the green colour value by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - Blue colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the blue colour value by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - Blue colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the blue colour value by pressing and holding the button (object 2).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 1 - White colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object used to send the white colour value by pressing the button briefly (object 1).				

Function	Name	Type	DPT	Flag
Short and long button actuation - Object 2 - White colour value	Disabling function *n* - Output	1-byte	5,001	C, R, -, T, A
1-byte object to send the white colour value by pressing and holding the button (object 2).				

Disabling function: Room temperature control point

Function	Name	Type	DPT	Flag
Operating mode	Disabling function *n* - Output	1-byte	20,102	C, R, -, T, A
1-byte object for switching a room temperature controller between the Comfort, Standby, Night and Frost/heat protection operating modes. This object is only visible if "Function = operating mode switchover".				

Function	Name	Type	DPT	Flag
Operating mode status	Disabling function *n* - Input	1-byte	20,102	C, -, W, -, U
1-byte object for receiving the operating mode of a room temperature controller. This object is only visible if "Function = operating mode switchover".				

Function	Name	Type	DPT	Flag
Forced operating mode	Disabling function *n* - Output	1-byte	20,102	C, R, -, T, A
1-byte object for switching a room temperature controller under forced control between the Automatic, Comfort, Standby, Night and Frost / heat protection operating modes. This object is only visible if "Function = forced operating mode switchover".				

Function	Name	Type	DPT	Flag
Forced operating mode status	Disabling function *n* - Input	1-byte	20,102	C, -, W, -, U
1-byte object for receiving the operating mode of a room temperature controller. This object is only visible if "Function = forced operating mode switchover".				

Function	Name	Type	DPT	Flag
Presence	Disabling function *n* - Output	1-bit	1,018	C, R, -, T, A
1-bit object for changing over the presence status of a room temperature controller. This object is only visible if "Function = presence function".				

Function	Name	Type	DPT	Flag
Presence status	Disabling function *n* - Input	1-bit	1,018	C, -, W, -, U
1-bit object for receiving the presence status of a room temperature controller. This object is only visible if "Function = presence function".				

Function	Name	Type	DPT	Flag
Setpoint shift	Disabling function *n* - Output	2-byte	9,002	C, R, -, T, A
2-byte object for presetting a basic setpoint shift in Kelvin. The value "0" means that no shift is active . Values can be specified between +2 K and -2 K. This object is visible only if "function = target temperature shift".				

Function	Name	Type	DPT	Flag
Setpoint shift status	Disabling function *n* - Input	2-byte	9,002	C, -, W, -, U
2-byte object for receiving the feedback from the current basic setpoint shift in Kelvin. This object is visible only if "function = setpoint shift".				

11.9 Energy saving mode

The device has an energy-saving mode to save electrical energy during operation. If the function is used, the device switches to the energy saving mode after a preset time without operation or controlled by an external telegram to a separate object. In the energy saving mode, essential display functions of the device are switched off. The status LEDs are then without any function and the display backlighting is switched off. The energy saving mode can be deactivated by actuating a button or by a special telegram. Afterwards, the device is fully functional again.

The energy saving mode can only be parameterised in the ETS if no alarm message is parameterised!

Activating energy saving mode

The device has two different activation options for setting the device to the energy saving mode. These can either be combined together or used separately.

Firstly, the device can be set to the energy saving mode by a group telegram via a communication object designated for this purpose. To do this, the telegram polarity that triggers the activation of the energy saving mode must be defined in the ETS.

Secondly, it is possible to switch to the energy saving mode automatically if no button has been actuated on the device within a defined time period. The time for this case is defined in the ETS. Each operation restarts the time for activating the energy saving mode.

On activation of energy-saving mode, all status LEDs and the display backlighting are switched off under forced control.

Any activation attempts of the energy saving mode are ignored while the programming mode of the device is active

Deactivating energy saving mode

The device has two different options for deactivation of energy-saving mode, which can be optionally combined.

Firstly, it is always possible to deactivate energy-saving mode automatically, as soon as the device is operated.

On the other hand, deactivation can also take place by a group telegram via the communication object designated for this purpose. For this purpose, the telegram polarity that triggers the deactivation of the energy saving mode must be defined in the ETS.

If an operation deactivates the energy saving mode, the device always executes the configured operating function immediately as well (e.g. switching, dimming, etc ...).

If the transmission flag is set at the energy-saving mode object, other devices can be informed about the deactivation of energy-saving mode by pressing a button on the local device, causing them also to leave energy-saving mode (prerequisite: all the devices are linked to the same group address and deactivation via an object must be possible in the configuration of the other devices). When energy-saving mode is deactivated when the transmission flag is set, the device sends an "Energy-saving mode deactivated" telegram to the bus, according to the inverted activated telegram polarity.

The device will activate the energy saving mode even if the operating areas are disabled. The energy saving mode (first operation) can also be deactivated by a disabled button. The configured operating functions (switching, dimming...) will not be executed thereby, however.

11.9.1 Table of parameters

General

Energy saving mode	Active **Inactive**
The energy saving mode can be enabled here. If the alarm signalling is enabled, the energy saving mode cannot be enabled.	

The following parameters are visible on the "Energy saving mode" parameter page if the energy saving mode has been activated.

Activating energy saving mode	**Via object** Automatically by time Automatically by time or via object
This parameter defines how the energy saving mode is activated in the device. Firstly, the device can be set to the energy saving mode by a group telegram via a communication object designated for this purpose. Secondly, it is possible to switch to the energy saving mode automatically if no button has been actuated within a defined time period.	

Deactivating energy saving mode	Automatically on operation **Automatically on operation or via object**
This parameter defines how the energy saving mode is deactivated in the device. Firstly, it is possible to deactivate energy-saving mode automatically, as soon as the device is operated. If an operation of the device deactivates the energy saving mode, the device always executes the configured operating function immediately as well (e.g. switching, dimming, etc.). Secondly, the energy saving mode can be deactivated by a group telegram via a communication object designated for this purpose. However, this possibility can only be combined with the automatic deactivation on operation.	

Polarity of the "Energy saving mode" object	0 = activate / 1 = deactivate **1 = activate / 0 = deactivate**
This parameter defines the telegram polarity for the object for activating or deactivating the energy saving mode.	

Time until energy saving mode is activated	1 ... **5** ... 60 min
This parameter defines the time that must elapse after an operation so that the device activates the energy saving mode. Each operation restarts the time.	

11.9.2 Object list

Function	Name	Type	DPT	Flag
Activate/deactivate	Energy saving mode - input	1-bit	1,003	C, -, W, -, U
1-bit object for activating or deactivating the energy saving mode. If the transmission flag is set, then other devices can be informed of the deactivation of energy-saving mode through operation on the local device, causing them also to leave energy-saving mode (precondition: all the devices are linked to the same group address and the deactivation via an object must be possible in the parameterisation of the other devices). When energy-saving mode is deactivated when the transmission flag is set, the device sends an "Energy-saving mode deactivated" telegram to the bus, according to the inverted activated telegram polarity.				

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